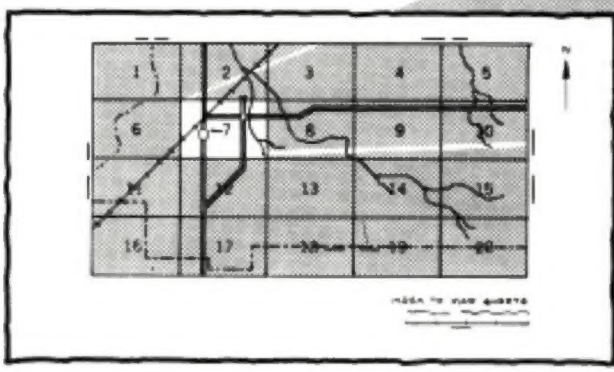
Soil Survey of

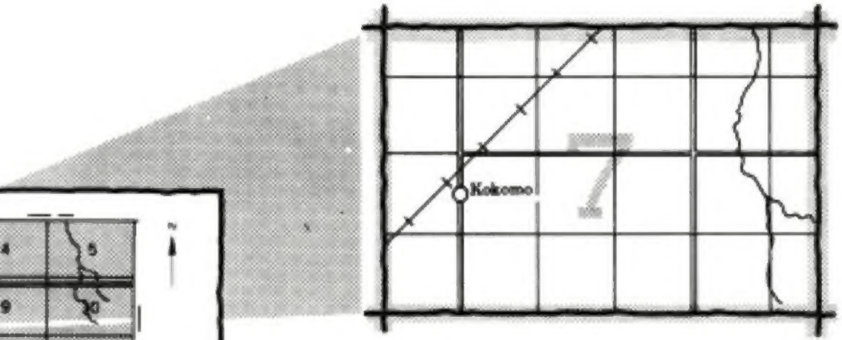
Union County, Illinois

United States Department of Agriculture
Soil Conservation Service and Forest Service
in cooperation with
Illinois Agricultural Experiment Station

HOW TO USE

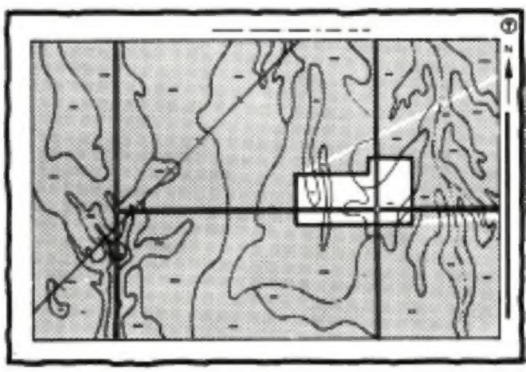
1. Locate your area of interest on the "Index to Map Sheets"

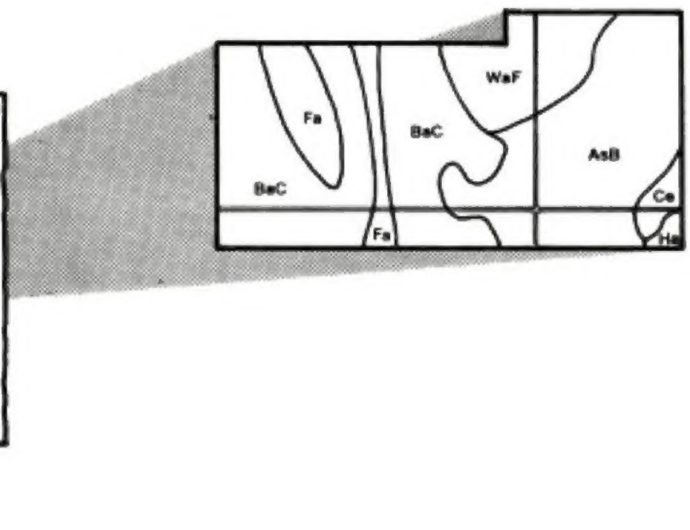




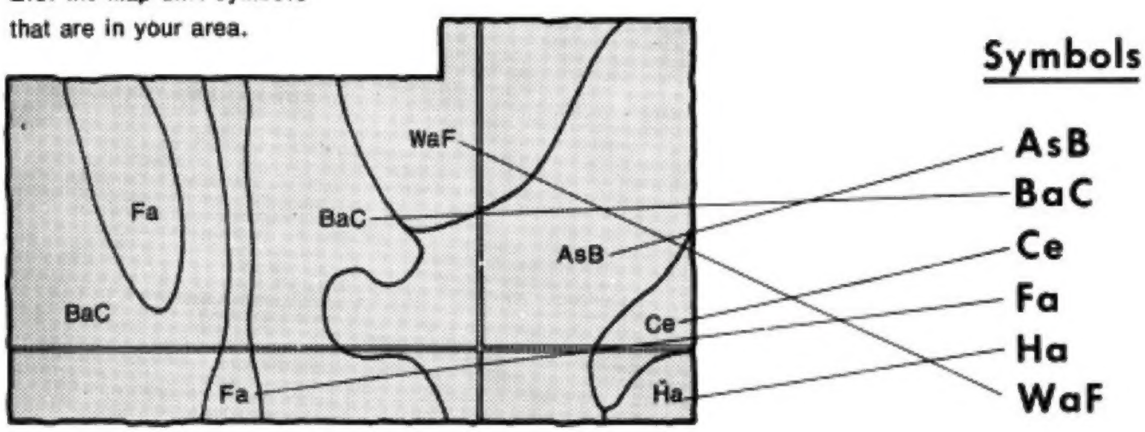
2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.



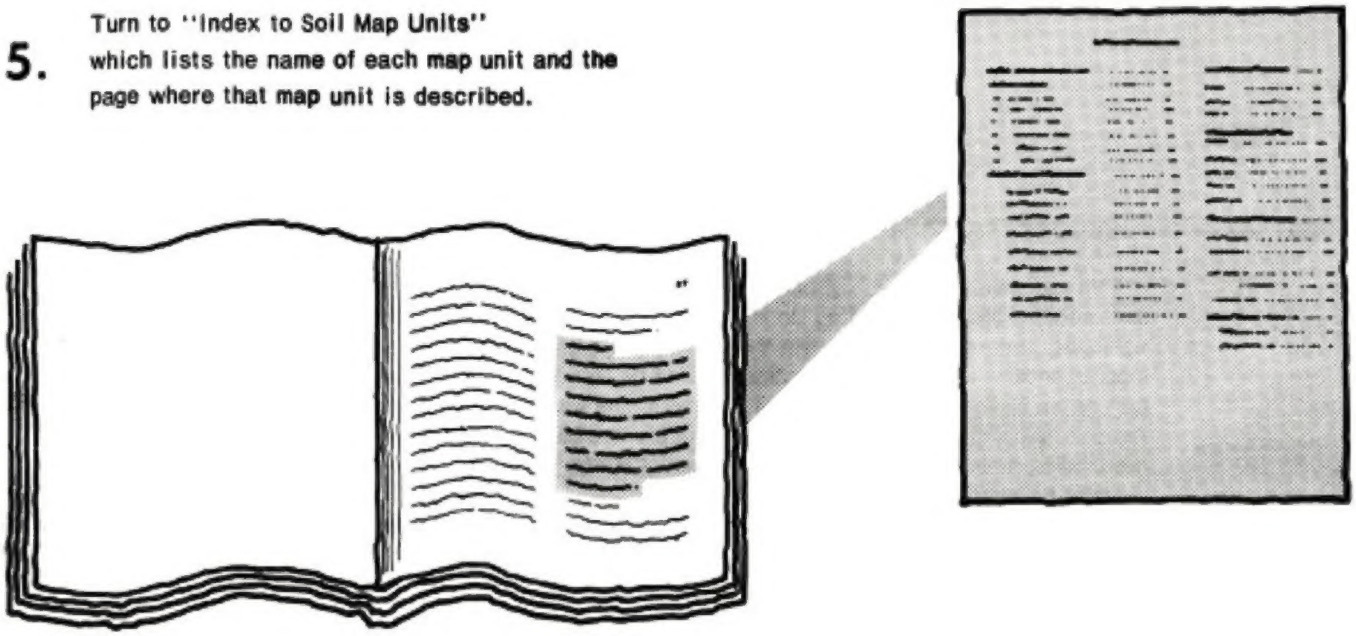


4. List the map unit symbols that are in your area.

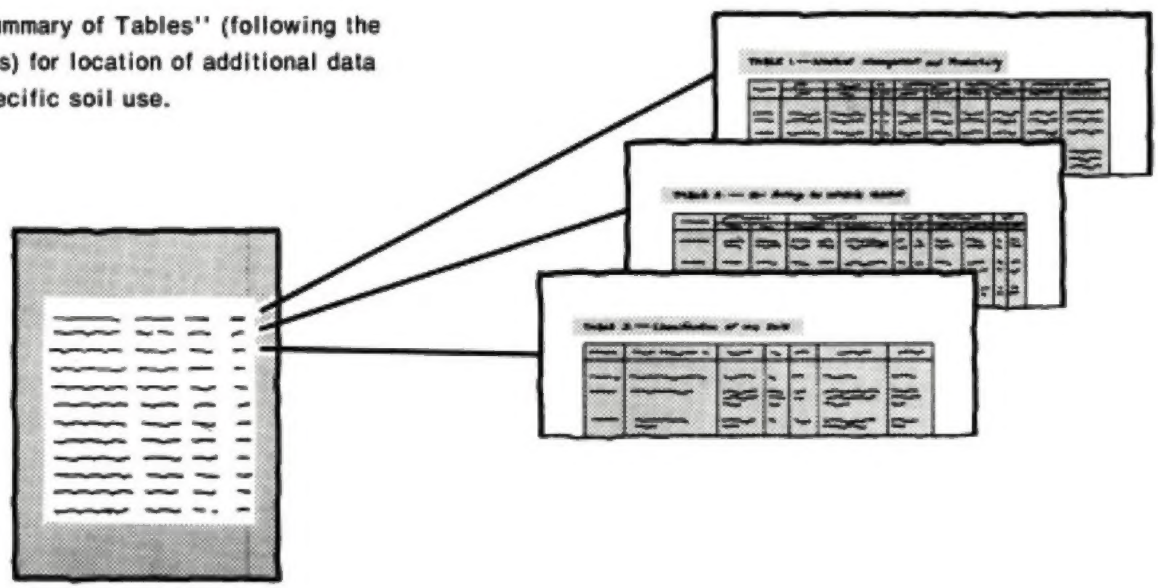


THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in the period 1971 to 1975. Soil names and descriptions were approved in 1976. Unless otherwise indicated, statements in the publication refer to conditions in the survey area in 1975. This survey was made cooperatively by the Soil Conservation Service, the Forest Service, and the Illinois Agricultural Experiment Station. It is part of the technical assistance furnished to the Union County Soil and Water Conservation District. The cost was shared by the Union County Board of Commissioners.

Soil maps in this survey may be copied without permission, but any enlargement of these maps can cause misunderstanding of the detail of mapping and result in erroneous interpretations. Enlarged maps do not show small areas of contrasting soils that could have been shown at a larger mapping scale.

This soil survey is Illinois Agricultural Experiment Station Soil Report No. 110.

Cover: A typical area in Union County. The area is dominantly Hosmer, Zanesville, and Westmore soils.

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Issued January 1979

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Summary of tables

Foreword

The Soil Survey of Union County, Illinois, contains much information useful in any land-planning program. Of prime importance are the predictions of soil behavior for selected land uses. Also highlighted are limitations or hazards to land uses that are inherent in the soil, improvements needed to overcome these limitations, and the impact that selected land uses will have on the environment.

This soil survey has been prepared for many different users. Farmers, foresters, and agronomists can use it to determine the potential of the soil and the management practices required for food and fiber production. Planners, community officials, engineers, developers, builders, and homebuyers can use it to plan land use, select sites for construction, develop soil resources, or identify any special practices that may be needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the soil survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur even within short distances. Soils may be seasonally wet or subject to flooding. They may be shallow to bedrock. They may be too unstable to be used as a foundation for buildings or roads. Very clayey or wet soils are poorly suited to septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map; the location of each kind of soil is shown on detailed soil maps. Each kind of soil in the survey area is described, and much information is given about each soil for specific uses. Additional information or assistance in using this publication can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

This soil survey can be useful in the conservation, development, and productive use of soil, water, and other resources.

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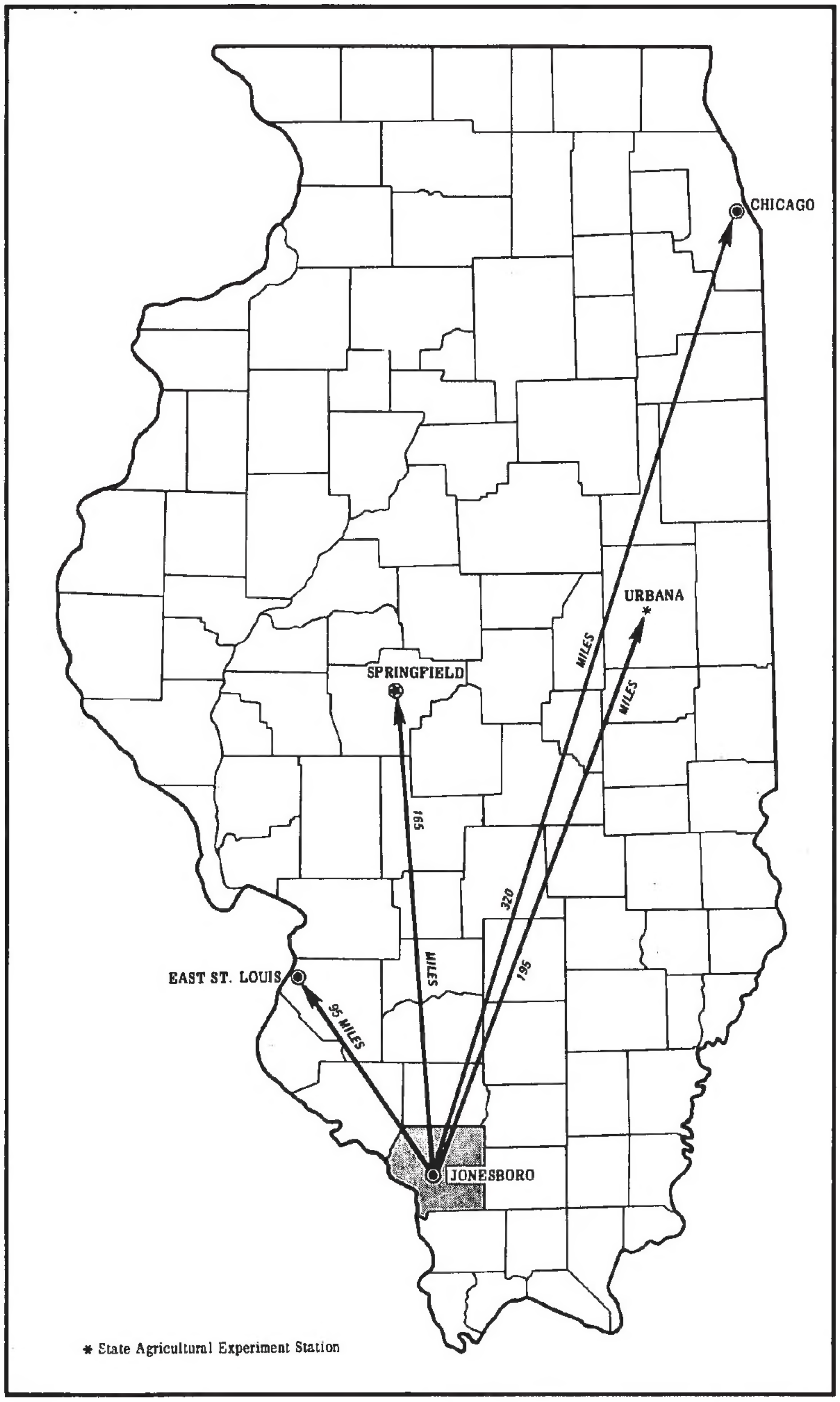

Location of Union County in Illinois.

SOIL SURVEY OF UNION COUNTY, ILLINOIS

By C. C. Miles, assisted by J. W. Scott, B. E. Currie, and L. A. Dungan, Soil Conservation Service

Fieldwork by B. E. Currie, L. A. Dungan, C. C. Miles, and J. W. Scott, Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service and Forest Service
in cooperation with Illinois Agricultural Experiment Station

UNION COUNTY is in the southern part of Illinois (see map on facing page). It has an area of about 424 square miles, or 271,360 acres (*7*). The Mississippi River forms the western boundary. In 1970, the population of the county was 16,071. Jonesboro, the county seat, has a population of 1,700 and Anna, the largest city, one of 4,786. Other towns and villages are Cobden, Alto Pass, Dongola, Lick Creek, Mill Creek, Reynoldsville, Ware, and Wolf Lake.

General nature of the county

Joe Barkley, district conservationist, Soil Conservation Service, helped prepare this section.

The following paragraphs give general information about Union County. They describe the climate, transportation facilities, natural resources, and relief, physiography, and drainage.

Climate

Union County is cold in winter but generally hot in summer. Winter precipitation, which frequently occurs as snow, results in a good accumulation of soil moisture by spring and minimizes drought during summer on most soils. The normal annual precipitation is adequate for all of the crops that are suited to the temperature and length of growing season in the survey area.

Table 1 gives data on temperature and precipitation for the survey area, as recorded at Anna, Illinois, for the period 1951 to 1973. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 36 degrees F, and the average daily minimum temperature is 27 degrees. The lowest temperature on record, which occurred at Anna on January 24, 1963, is -12 degrees. In summer the average temperature is 77 degrees, and the average daily maximum temperature is 88 degrees. The highest recorded temperature, which occurred on July 28, 1952, is 107 degrees.

Growing degree days, shown in table 1, are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

Of the total annual precipitation, 25 inches, or 54 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 20 inches. The heaviest 1-day rainfall during the period of record was 5.4 inches at Anna on March, 9, 1964. Thunderstorms occur on about 53 days each year, and most occur in summer.

Average seasonal snowfall is 13 inches. The greatest snow depth at any one time during the period of record was 14 inches. On the average, 6 days have at least 1 inch of snow on the ground, but the number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The percentage of possible sunshine is 75 in summer and 50 in winter. The prevailing wind is from the southwest. Average windspeed is highest, 11 miles per hour, in March.

Tornadoes and severe thunderstorms occur occasionally. These storms are usually local and of short duration and cause damage in an erratic pattern.

Climatic data in this section were specially prepared for the Soil Conservation Service by the National Climatic Center, Asheville, North Carolina.

Transportation facilities

Transportation facilities generally are good. The county is crossed from north to south by Interstate Highway 57 and U. S. Highway 51 and by State Routes 3 and 127 and from east to west by State Route 146. It has a good system of secondary roads, most of which are hard surfaced.

Railroads, although declining in use, provide valuable transportation service. All of the railroad lines run north and south and pass through most of the towns.

Natural resources

About 155,608 of the 271,360 acres in Union County is farmland. Of the 1,565 farms in the county, many of which are less than 100 acres in size, less than 8 percent are operated by tenants. Most owners or operators, however, supplement their income by working off the farm. A number of small industries provide employment. The average age of the farm operators is 52.3 years.

Union County has produced fruit, particularly apples and peaches, and vegetables. Although the extent has declined over the years, a fairly large acreage still produces fruit and vegetables. Erosion is only a minor problem in the orchards, most of which are kept in sod. It commonly is moderate to severe, however, in areas where vegetables are grown. In these areas, the crops generally are clean tilled and little crop residue is returned to the soil.

Two stone quarries operate in Union County. One, at the east edge of Anna, produces mostly road rock. The other, near Mill Creek, produces agricultural limestone.

The Shawnee National Forest occupies about 35,023 acres in the county and the State of Illinois 13,240 acres. The county has two water districts—the Shawnee Valley and the Lick Creek Water Districts.

Relief, physiography, and drainage

Rock formations belonging to the Pennsylvanian, Mississippian, and Devonian periods crop out in Union County. The youngest rocks, or the Pennsylvanian rocks, which are roughly north of a line from Alto Pass to Lick Creek, generally form the highest elevations in the county. The Mississippian rocks are in the eastern half of the county. Sandstone, limestone, or shale can crop out locally. For the most part, the sandstone is in the northeastern part of the county and the limestone in the southwestern part. The Devonian rocks are along the west side of the county, roughly west of a line from Alto Pass to Mill Creek. Most are cherty, but some are shale or limestone. The bedrock has a northeast-southwest strike and dips northeast 1 degree to 2 degrees.

In Union County, the Mississippi River is about 340 feet above sea level. The bottom land ranges in elevation from 340 to about 360 feet. Generally, the Devonian bedrock hills adjacent to bluffs along the Mississippi River rise to an elevation of 600 to 800 feet, the Mississippian bedrock hills to one of 500 to 650 feet, and the Pennsylvanian bedrock hills to one of 700 to 850 feet. Bald Knob, which is near Alto Pass in the northwest part of the county, has an elevation of 1,050 feet. It is the third highest point in Illinois.

Except for the bottom land along the Mississippi River and Cypress and Upper Cache Creeks and the narrow valleys along the smaller streams, Union County is mainly gently rolling to hilly. Vegetables are commonly grown on the narrow bottom land, whereas row crops commonly are intensively grown on the wider bottom land along the larger streams. The uplands, mostly windblown loess deposited over sandstone and limestone, commonly have been used for pasture, woodland, and orchards, but the trend is toward row crops.

The soils range mainly from well drained in the uplands to poorly drained on the wider bottom land. Many of the bottom land soils are suited to tile drainage, but the lack of outlets limits subsurface drainage. Most excavated ditches function only when the Mississippi River is low. The bottom land along Cypress and Upper Cache Creeks is flooded annually. Although leveed, much of the bottom land along the Mississippi River is inundated annually by seep water or backwater.

How this survey was made

Soil scientists made this survey to learn what kinds of soil are in the survey area, where they are, and how they can be used. The soil scientists went into the area knowing they likely would locate many soils they already knew something about and perhaps identify some they had never seen before. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; the kinds of rock; and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material, which has been changed very little by leaching or by the action of plant roots.

The soil scientists recorded the characteristics of the profiles they studied, and they compared those profiles with others in counties nearby and in places more distant. Thus, through correlation, they classified and named the soils according to nationwide, uniform procedures.

After a guide for classifying and naming the soils was worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, roads, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

The areas shown on a soil map are called soil map units. Some map units are made up of one kind of soil, others are made up of two or more kinds of soil, and a few have little or no soil material at all. Map units are discussed in the sections "General soil map for broad land-use planning" and "Soil maps for detailed planning."

While a soil survey is in progress, samples of soils are taken as needed for laboratory measurements and for engineering tests. The soils are field tested, and interpretations of their behavior are modified as necessary during the course of the survey. New interpretations are added to meet local needs, mainly through field observations of different kinds of soil in different uses under different levels of management. Also, data are assembled from other sources, such as test results, records, field experience, and information available from state and local specialists. For example, data on crop yields under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it is readily available to different groups of users, among them farmers, managers of woodland, engineers, planners, developers and builders, homebuyers, and those seeking recreation.

General soil map for broad land-use planning

The general soil map at the back of this publication shows, in color, the associations in this survey area. Each association has a distinct pattern of soils and of relief and drainage. Each is a unique natural landscape. Typically, an association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in other associations but in a different pattern.

The general soil map provides a broad perspective of the soils and landscapes in the survey area. It provides a basis for comparing the potential of large areas for general kinds of land use. Areas that are, for the most part, suited to certain kinds of farming or to other land uses can be identified on the map. Likewise, areas of soils having properties that are distinctly unfavorable for certain land uses can be located.

Because of its small scale, the map does not show the kind of soil at a specific site. Thus, it is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The kinds of soil in any one association differ from place to place in slope, depth, stoniness, drainage, or other characteristics that affect their management.

Descriptions of associations

1. Wakeland-Haymond association

Nearly level, somewhat poorly drained and well drained soils formed in silty alluvial deposits

This association consists of nearly level soils on flood plains. It is along the streams that dissect the uplands throughout the county.

This association occupies about 10 percent of the county. It is about 45 percent Wakeland soils, 25 percent Haymond soils, and 30 percent soils of minor extent.

The somewhat poorly drained Wakeland soils are generally on the broader flood plains along the larger streams. The well drained Haymond soils are generally on the narrow flood plains where stream gradient is greater. Both soils are silt loam throughout. In most areas they are subject to flooding.

Minor in this association are Birds, Piopolis, Elsah, and Burnside soils. Birds and Piopolis soils are poorly drained. Elsah soils contain chert fragments within a depth of 25 inches. They are mainly along the western edge of the county. Burnside soils contain sandstone fragments within a depth of 24 inches. They are mainly in the northeastern part of the county.

This association is used mainly for cultivated crops, but some areas are pasture or woodland. Flooding is the main limitation for most uses. A seasonal high water table is a problem in some low-lying areas.

This association has good potential for cultivated crops. It has poor potential for residential and urban uses because overcoming the flood hazard is difficult. The potential for development of wildlife habitat and for woodland is generally good. Protection against overflow and drainage of the wetter areas are the main management needs.

2. Karnak-Darwin-Jacob association

Nearly level, poorly drained or very poorly drained soils formed in clayey alluvial deposits

This association consists of nearly level soils on broad flats and in narrow depressions or sloughs on the flood plain of the Mississippi River. It occupies about 6 percent of the county. It is about 35 percent Karnak soils, 20 percent Darwin soils, 15 percent Jacob soils, and 30 percent soils of minor extent and areas of water.

The major soils have a silty clay surface layer and a clay or silty clay subsoil. They are difficult to till. They crack when dry and swell when wet. They are slow to dry out in spring and in many areas are ponded for extended periods. Water moves very slowly through the soils.

Minor in this association are the poorly drained Cairo and the somewhat poorly drained Bowdre, Tice, and Dupo soils. These soils are slightly higher on the landscape than the major soils.

This association is used mainly for cultivated crops, but some areas remain in native hardwoods. Woodland is more common on the Jacob soils. Some ponded areas provide wetland wildlife habitat. Wetness and overflow are the main limitations.

This association has fair potential as cropland if it is adequately drained. It has poor potential for most urban or residential uses and for recreation uses because of the overflow and the high content of clay. Many areas have good potential as habitat for wetland wildlife.

3. Ware-Medway association

Nearly level and gently sloping, moderately well drained soils formed in silty, loamy, and sandy alluvial deposits

This association consists of soils on flood plains along the Mississippi River. It occupies about 7 percent of the county. It is about 30 percent Ware soils, 30 percent Medway soils, and 40 percent soils of minor extent (fig. 1).

The loamy Ware soils are on the slightly higher ridges. They contain somewhat more sand and less clay in the upper part than the silty Medway soils.

Minor in this association are mainly the excessively drained Sarpy, the poorly drained Gorham, and the somewhat poorly drained Bowdre soils. These soils are slightly lower on the landscape than the major soils. The sandy Sarpy soils are on ridges.

This association is used mainly for cultivated crops. It is well suited to row crops, but the soils outside the levee are subject to frequent flooding. Some of the more sandy areas are susceptible to soil blowing if the surface is bare.

This association has good potential for cultivated crops, fruits, and vegetables. The potential for residential uses is poor because flooding is a hazard. Also, the ground water supply can be contaminated by effluent from onsite waste disposal systems. The potential for openland wildlife habitat and most recreation uses is good.

4. Hosmer association

Gently sloping to moderately steep, moderately well drained soils that have a fragipan and that formed in loess

This association consists mainly of soils on hills, ridges, and side slopes. It occupies about 16 percent of the county. It is about 65 percent Hosmer soils and 35 percent soils of minor extent.

Hosmer soils have moderately permeable upper layers and slowly permeable lower layers. The surface layer is silt loam, and the subsoil is silty clay loam and silt loam. A compact, brittle fragipan is within a depth of 24 to 36 inches in most areas.

Minor in this association are Alford, Stoy, Zanesville, and Wakeland soils. Alford soils are higher on the landscape than the major soils. Stoy soils are at the head of drainageways. Zanesville soils are lower on the landscape than the major soils. Wakeland soils are on narrow bottom land.

This association is used mainly for cultivated crops, hay, and pasture. Some areas support native hardwoods. The erosion hazard and the slope are the main management problems.

The less steep areas have fair potential for cultivated crops and fair or poor potential for residential development. The potential for development of openland or woodland wildlife habitat is fair to good.

5. Hosmer-Zanesville association

Gently sloping to moderately steep, moderately well drained soils that have a fragipan and that formed in loess or in loess and material weathered from sandstone and siltstone

This association consists mainly of soils on ridges and hills. It occupies about 15 percent of the county. It is about 40 percent Hosmer soils, 15 percent Zanesville soils, and 45 percent soils of minor extent.

Hosmer soils are on the tops and sides of ridges and on hillsides. Zanesville soils are mainly on long hillsides. Bedrock escarpments are common on many of these hillsides. Both soils have a silt loam surface layer and a silt loam or silty clay loam subsoil. In both the lower part of the subsoil is a brittle, compact fragipan. Zanesville soils formed partly in material weathered from bedrock and contain sand grains and coarse fragments.

Minor in this association are Alford, Westmore, Wellston, and Burnside soils. Alford soils are higher on the landscape than the major soils, and Westmore and Wellston soils are lower. Alford soils do not have the fragipan characteristic of the major soils. Burnside soils are on narrow bottom land.

This association is used mainly for cultivated crops, pasture, or woodland. The erosion hazard, the slope, and the rooting depth are the main management problems. Also, rock crops out in places.

The less sloping areas have fair potential for cultivated crops and poor potential for residential development. Most of the acreage has good potential for woodland, for openland or woodland wildlife habitat, and for hiking trails or sightseeing areas.

6. Alford-Wellston association

Gently sloping to steep, well drained soils formed in loess or in loess and material weathered from sandstone and siltstone

This association consists mainly of soils on ridges and hills. It occupies about 11 percent of the county. It is about 60 percent Alford soils, 10 percent Wellston soils, and 30 percent soils of minor extent (fig. 2).

Alford soils are on the parts of ridgetops and hillsides where the layer of loess is thickest. They have a silt loam surface layer and a silty clay loam subsoil. Wellston soils are on the lower, generally steeper hillsides where material weathered partly from bedrock is within 40 inches of the surface. The surface layer is silt loam, and the subsoil is silt loam and very channery silty clay loam.

Minor in this association are Hosmer, Zanesville, Neotoma, Haymond, and Burnside soils. Hosmer and Zanesville soils are downslope from Alford soils and upslope from Wellston soils. Neotoma soils are on foot slopes. Haymond and Burnside soils are on narrow bottom land.

This association is used mainly for pasture and woodland, but some areas are used for cultivated crops, orchards, or vegetables. The erosion hazard and the slope are the main management problems. In some areas the soils are stony.

This association has fair to poor potential for cultivated crops and for residential or recreational development. Most areas have good potential for woodland, for woodland or openland wildlife habitat, and for orchards. Much of the acreage has good potential for hiking trails or sightseeing areas.

7. Alford association

Gently sloping to moderately steep, well drained soils formed in loess

This association consists of soils in the uplands. It occupies about 17 percent of the county. It is about 70 percent Alford soils and 30 percent soils of minor extent.

Alford soils occupy ridgetops and most of the hillsides where cherty limestone is generally covered by a layer of loess more than 5 feet thick. They have a silt loam surface layer and a silty clay loam subsoil.

Minor in this association are Hosmer, Baxter, Haymond, and Elsah soils. Hosmer soils are downslope from Alford soils. Baxter soils are on foot slopes along drainageways. Haymond and Elsah soils are on narrow bottom land.

Most areas are used for cultivated crops, hay, or pasture. Some areas remain in native hardwoods. The erosion hazard and the slope are the main concerns of management.

This association has fair to poor potential for cultivated crops and for residential or recreational development. Most areas have good potential as woodland and as openland or woodland wildlife habitat. Much of the acreage has good potential for hiking trails and sightseeing areas.

8. Goss-Alford association

Moderately steep to very steep, well drained soils formed in material weathered from cherty limestone or in loess

This association consists mainly of very hilly soils on bluffs along the flood plain of the Mississippi River. It occupies about 18 percent of the county. It is about 50 percent Goss soils, 30 percent Alford soils, and 20 percent soils of minor extent.

Goss soils are on the mid and lower parts of hillsides. They formed in cherty limestone and have a cherty, clayey subsoil. Alford soils are on the upper side slopes and narrow ridgetops. They formed in loess and are silty throughout.

Minor in this association are Elsah, Haymond, and Wakeland soils. These soils are on narrow bottom land.

This association is mainly native woodland, but a few areas are pastured. The slope, a severe erosion hazard, and the cherty, clayey subsoil limit the use of this association. Also, small areas on bottom land are subject to flash flooding.

Most areas have good potential as woodland, habitat for woodland wildlife, and hiking trails or sightseeing areas. The potential for most other uses is poor.

Broad land-use considerations

The potential for cultivated crops is good in most areas of the Wakeland-Haymond and Ware-Medway associations and fair in most areas of the Karnak-Darwin-Jacob association. The soils in these associations are nearly level or gently sloping and generally occur as broad areas. All but those in the Karnak-Darwin-Jacob association can be tilled easily, have a moderate to very high available water capacity, and respond well to management. Poor tilth is a problem on the Karnak-Darwin-Jacob association.

Most areas in the Wakeland-Haymond association are subject to flooding. Yields can vary on the soils between the levee and the Mississippi River where flooding is frequent. Local overflow or ponding is a problem on most of the soils in the Karnak-Darwin-Jacob association.

The gently sloping, slightly eroded areas of the Hosmer, Hosmer-Zanesville, Alford-Wellston, and Alford associations have good potential for cultivated crops. These soils can be tilled easily. Available water capacity is moderate or high. The less sloping soils are generally in irregularly shaped areas. Erosion is the main problem.

Most areas in the Hosmer, Hosmer-Zanesville, Alford-Wellston, and Alford associations have good potential for hayland or pasture. The soils respond well to pasture renovation and other management. The growing season is long. If suitable species of grass are selected and grazing is rotated, the pasture can be grazed nearly year round.

Because air drainage is good in most places and the supply of available water is adequate, all areas of the Hosmer, Hosmer-Zanesville, Alford, and Alford-Wellston associations except the areas of severely eroded Hosmer soils have good potential for apples and peaches. The gently sloping, less eroded soils in these associations have good potential for most vegetables and other specialty crops. These soils are moderately well drained or well drained, warm up early in spring, and are in good tilth. Erosion is the main problem. The silty, loamy, or sandy soils in the Wakeland-Haymond and Ware-Medway associations have good potential for most vegetables. These crops can be damaged by floodwater during some years.

Most soils in the county have good or fair potential for woodland. Commercially valuable trees are commonly grown on the Goss-Alford, Alford-Wellston, Hosmer-Zanesville, and Karnak-Darwin-Jacob associations. Shawnee National Forest extends into parts of these associations.

The hilly, commonly wooded areas of the Goss-Alford, Hosmer-Zanesville, Alford-Wellston, and Alford associations have good potential as sites for parks and as extensive recreation areas. The high linear ridges, incised valleys, and rock formations enhance the beauty of many areas. Undrained marshy areas of the Karnak-Darwin-Jacob association and some areas of the Wakeland-Haymond association on the wider bottom land along the larger streams have good potential as nature-study areas.

Deciding which land should be used for residential development is important in the survey area. Each year land is developed for urban use in Anna, Jonesboro, Dongola, Cobden, and other towns and in the surrounding countryside. The general soil map is helpful in planning the general outline of residential areas, but it cannot be used in selecting sites for specific structures. In general, the soils that have good potential for cultivated crops also have good potential for urban development. The data about specific soils in this survey can be helpful in planning future land-use patterns.

Areas where the soils are unfavorable for residential development are extensive in the survey area. On the Wakeland-Haymond, Karnak-Darwin-Jacob, and Ware-Medway associations, which are on flood plains, flooding and ponding in low-lying areas are severe limitations.

Development is costly on many parts of the Hosmer-Zanesville and Alford-Wellston associations where the soils are steep and bedrock is a few feet below the surface. The Goss-Alford association has poor potential for residential development because of steepness and because of the stoniness and high shrink-swell potential of the Goss soils.

In other areas of the county, the soils can be developed for residential uses at a lower cost. Parts of the Alford and Hosmer associations and the less sloping parts of the Hosmer-Zanesville and Alford-Wellston associations are examples.

Soil maps for detailed planning

The map units shown on the detailed soil maps at the back of this publication represent the kinds of soil in the survey area. They are described in this section. The descriptions together with the soil maps can be useful in determining the potential of a soil and in managing it for food and fiber production; in planning land use and developing soil resources; and in enhancing, protecting, and preserving the environment. More information for each map unit, or soil, is given in the section "Use and management of the soils."

Preceding the name of each map unit is the symbol that identifies the soil on the detailed soil maps. Each soil description includes general facts about the soil and a brief description of the soil profile. In each description, the principal hazards and limitations are indicated, and the management concerns and practices needed are discussed.

The map units on the detailed soil maps represent an area on the landscape made up mostly of the soil or soils for which the unit is named. Most of the delineations shown on the detailed soil map are phases of soil series.

Soils that have profiles that are almost alike make up a *soil series*. Except for allowable differences in texture of the surface layer or of the underlying substratum, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement in the profile. A soil series commonly is named for a town or geographic feature near the place where a soil of that series was first observed and mapped. The Ware series, for example, was named for the town of Ware in Union County.

Soils of one series can differ in texture of the surface layer or in the underlying substratum and in slope, erosion, stoniness, salinity, wetness, or other characteristics that affect their use. On the basis of such differences, a soil series is divided into phases. The name of a *soil phase* commonly indicates a feature that affects use or management. For example, Hosmer silt loam, 2 to 6 percent slopes, is one of several phases within the Hosmer series.

Some map units are made up of two or more dominant kinds of soil. Such map units are called soil complexes. A *soil complex* consists of areas of two or more soils that are so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area includes some of each of the two or more dominant soils, and the pattern and proportion are somewhat similar in all areas. Goss-Alford complex, 30 to 70 percent slopes, is an example.

Most map units include small, scattered areas of soils other than those that appear in the name of the map unit. Some of these soils have properties that differ substantially from those of the dominant soil or soils and thus could significantly affect use and management of the map unit. These soils are described in the description of each map unit. Some of the more unusual or strongly contrasting soils that are included are identified by a special symbol on the soil map.

Most mapped areas include places that have little or no soil material and support little or no vegetation. Such places are called *miscellaneous areas*; they are delineated on the soil map and given descriptive names. Pits, quarry, limestone, is an example. Some of these areas are too small to be delineated and are identified by a special symbol on the soil map.

The acreage and proportionate extent of each map unit are given in table 4, and additional information on properties, limitations, capabilities, and potentials for many soil uses is given for each kind of soil in other tables in this survey. (See "Summary of tables.") Many of the terms used in describing soils are defined in the Glossary.

71—Darwin silty clay. This nearly level, poorly drained and very poorly drained soil is on broad flats and in narrow depressions or sloughs on the flood plain of the Mississippi River. It is on the protected side of the levee. It is subject to rare flooding. Individual areas are long or round and range from 20 to more than 200 acres in size.

Typically, the surface layer is very dark gray silty clay about 10 inches thick. The subsoil to a depth of about 62 inches is gray and dark gray silty clay and silty clay loam mottled with olive brown, brown, and dark reddish brown. In places strata of clay loam, loam, or fine sandy loam are below a depth of 40 inches.

Included with this soil in mapping are spots near some overflow channels where sandy or silty overwash is part of the surface layer. Also included are small depressional areas where surface water ponds for extended periods. Included areas make up about 5 to 10 percent of this unit.

Water and air move through this soil at a very slow rate, and surface runoff is slow to ponded. The subsoil is slightly acid to mildly alkaline. The surface layer is very hard when dry and very sticky when wet. Clods form if the soil is worked when wet. Organic-matter content and natural fertility are moderate. Available water capacity is moderate. The seasonal high water table is within 2 feet of the surface in winter and spring. This clayey soil swells during wet periods and shrinks during dry periods. Wide cracks form during dry periods.

Most areas are farmed. This soil has fair potential for cultivated crops. It has poor to fair potential for hay, pasture, or trees and fair potential for wetland wildlife habitat. The potential for building site development and septic tank absorption fields is poor.

This soil is suited to row crops. Shallow ditches at close intervals and land leveling commonly reduce wetness. Because of the very slow permeability, subsurface tile functions satisfactorily only as a surface inlet, which drains surface water in wet spots. Tilth is poor but can be improved by plowing in the fall, providing drainage, and incorporating crop residue or other organic material into the surface layer. Conservation tillage reduces soil compaction.

Hay and pasture are suited to this soil if adequate drainage is provided. Grasses and legumes that are tolerant of wetness should be selected. Pasture rotation and restricted use during wet periods keep the pasture and the soil in good condition.

As a result of the very slow permeability and the low-lying position on the landscape, this soil is well suited to the development of habitat for wetland wildlife.

Sewage lagoons can be installed on this soil only if they are properly designed and laid out and are adequately protected against overflow.

Capability subclass IIIw.

75C—Drury silt loam, 3 to 10 percent slopes. This gently sloping and sloping, well drained soil is on foot slopes or terraces below the bluffs adjacent to bottom land along the Mississippi River. Individual areas are irregular in shape and range from about 5 to 25 acres in size.

Typically, the surface layer is dark brown silt loam about 6 inches thick. The subsoil is dark brown and dark yellowish brown silt loam about 27 inches thick. The substratum to a depth of about 68 inches is dark yellowish brown and light brownish gray silt loam. In some places the surface layer is loam. In others chert fragments are on the surface and throughout the profile.

Included with this soil in mapping are small areas of Elsah soils on terraces. These soils have a cherty layer within a depth of 25 inches. They make up about 5 to 15 percent of this unit.

Water and air move through this soil at a moderate rate, and surface runoff is medium. The subsoil is slightly acid or medium acid. The surface layer is very friable and can be easily tilled throughout a wide range in moisture content. Organic-matter content is low, and natural fertility is moderate. Available water capacity is very high.

Most areas are farmed. This soil has good potential for cultivated crops, for trees, and for building site development and septic tank absorption fields.

This soil is well suited to row crops, small grain, grasses, legumes, and specialty crops. Erosion is a hazard. Conservation tillage, contour farming, and cover crops help to prevent excessive soil loss. Also, grassed waterways or diversion terraces can keep the runoff in the higher lying areas from flowing across the soil.

Hay and pasture crops are well suited to this soil. They are effective in controlling erosion. Proper stocking rates, pasture rotation, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is well suited to woodland. Controlling plant competition helps to obtain maximum growth rates. Harvesting mature trees, cutting cull trees, weeding, and thinning reduce plant competition.

This soil has few limitations as a site for buildings, local roads, or waste disposal systems. The main concern is controlling erosion in exposed areas during construction. The effluent from onsite waste disposal systems can contaminate the ground water supply.

Capability subclass IIe.

85—Jacob silty clay. This nearly level, poorly drained or very poorly drained soil is on broad flats and in depressions or narrow channels on bottom land along the Mississippi River. It is subject to rare flooding. Individual areas are mainly long or round and range from about 20 to more than 400 acres in size.

Typically, the surface layer is grayish brown silty clay about 9 inches thick. The subsoil is grayish brown, olive gray, and gray, mottled clay about 47 inches thick. The substratum to a depth of about 60 inches is olive gray silty clay. In places the surface layer is thicker and darker. In a few areas the substratum is loamy and more brownish.

Included with this soil in mapping are small depressional areas where surface water ponds for extended periods. Also included are a few places along overflow channels where loamy overwash covers the surface and a few areas where slopes are short and steep. Included areas make up about 5 to 15 percent of this unit.

Water and air move through this soil at a very slow rate, and surface runoff is slow to ponded. The subsoil ranges from strongly acid to extremely acid. The surface layer is very firm and difficult to till. Clods form if the soil is worked when wet. Organic-matter content and natural fertility are low. Available water capacity is moderate. The growth of roots is restricted by the high content of clay and the strongly acid to extremely acid subsoil and in most years by a fluctuating water level. The water table is perched within 1 foot of the surface at various times from February to July. The soil shrinks during dry periods and swells during wet periods. Wide cracks form during dry periods. The choice of plants is restricted by overflow in some years.

Most areas are woodland. Some areas have been cleared for cultivated crops. This soil has poor to fair potential for cultivated crops and for hay, pasture, and trees. The potential for recreation uses and for building site development and septic tank absorption fields is poor. The potential for wildlife habitat is fair.

This soil is suited to row crops and small grain if the wetness and the overflow hazard are controlled. Shallow ditches at close intervals and land leveling commonly reduce the wetness. Surface tilth can be improved by incorporating crop residue into the soil and by reducing compaction through conservation tillage.

Hay and pasture plants can be grown on this soil if adequate drainage and protection against overflow are provided. Grasses and legumes that are tolerant of wetness should be selected. Restricted use during wet periods keeps the pasture and the soil in good condition.

This soil is moderately suited to woodland. Many areas remain in native hardwoods. As a result of the clayey surface layer, seedling mortality is severe and the effective use of mechanical planters is restricted. Flooding and deposition can damage seedlings. Plant competition can be controlled by harvesting mature trees, cutting cull trees, weeding, and thinning.

The areas left in native hardwoods are well suited to woodland wildlife habitat. The cleared areas are well suited to the development of habitat for wetland wildlife.

Sewage lagoons can be installed on this soil only if they are properly designed and laid out and if adequately protected against overflow.

Capability subclass IVw.

92—Sarpy loamy fine sand. This nearly level and gently sloping, excessively drained soil is on ridges and natural levees on the flood plain along the Mississippi River. It is on the protected side of the levee. Individual areas are long and range from about 5 to 20 acres in size.

Typically, the surface layer is dark brown loamy fine sand about 6 inches thick. The subsurface layer is brown loamy very fine sand about 8 inches thick. The substratum to a depth of about 60 inches is yellowish brown and pale brown loamy fine sand. In places it has thin loamy layers.

Included with this soil in mapping are a few areas where slopes are short and steep. Also included, in slight depressions, are a few areas of Ware and Medway soils, which contain less sand than the Sarpy soil. Included areas make up about 5 to 10 percent of this unit.

Water and air move through this soil at a rapid rate, and surface runoff is slow. The surface layer is very friable and can be easily tilled. It dries out quickly after rains and warms up early in spring. Organic-matter content and natural fertility are low. Available water capacity also is low.

Most areas are farmed. This soil has fair potential for cultivated crops, hay, pasture, and some specialty crops. It has poor potential for trees. The potential for building site development and septic tank absorption fields is good.

This soil is suited to row crops, wheat, grasses and legumes, and some specialty crops. The limited available water capacity is the main management concern. Crops that are drought resistant should be favored. Conservation tillage, cover crops, and crop residue help in control-

ling soil blowing and water erosion and in conserving soil moisture.

This soil is well suited to certain specialty crops, such as muskmelons or watermelons. It is suited to vegetable gardens only if the vegetables are grown early in the growing season; it is too droughty for vegetables during the summer. Several small applications of fertilizer, rather than one large application, are needed. Irrigation is beneficial.

Hay and pasture are well suited to this soil. They are effective in controlling erosion. During dry years yields can be reduced. If overgrazing is avoided and hay cutting limited, an adequate plant cover can be maintained during these years.

This soil is very poorly suited to woodland. The expected growth rate is low, and seedling mortality is severe. Competition from undesirable plants can be controlled by proper site preparation, by thinning, by cutting cull trees, and by weeding.

This soil is well suited as a site for buildings, local roads, and waste disposal systems. A break in the levee, however, is a possibility during high flood stages. The soil is suitable as drain or bedding material or as subbase material for local roads. The effluent from onsite waste disposal systems can contaminate the ground water supply.

Capability subclass IIIs.

162—Gorham silty clay loam. This nearly level, poorly drained soil is mainly on low ridges and in other areas on the flood plain of the Mississippi River. It is on the protected side of the levee. Because it is generally low lying, however, it is subject to overflow for brief periods during rainy seasons. Individual areas are mainly long and range from 5 to 30 acres in size.

Typically, the surface layer is very dark grayish brown silty clay loam about 11 inches thick. The subsoil is about 32 inches thick. It is very dark grayish brown and dark grayish brown silty clay loam in the upper part and dark grayish brown clay loam in the lower part. The substratum to a depth of about 60 inches is dark brown fine sandy loam and loamy fine sand over light brownish gray fine sand. In some areas the subsoil has thin strata of silty clay. In places the substratum is clay loam.

Included with this soil in mapping are the moderately well drained Medway soils on slight rises and the more clayey Cairo soils in depressional areas. Also included are areas near overflow channels where the surface layer is loamy. Included areas make up about 10 to 15 percent of this unit.

Water and air move through the upper part of this soil at a moderately slow rate and through the more sandy lower part at a moderately rapid rate. Surface runoff is slow. The subsoil ranges from slightly acid to mildly alkaline. The surface layer is firm and is somewhat difficult to work when wet. The seasonal high water table is within 3 feet of the surface in the spring. Organic-matter content is medium, and natural fertility is high. Available water capacity also is high.

Most areas are used for cultivated crops. This soil has good potential for row crops, hay, pasture, and trees. It has fair potential as habitat for woodland and wetland wildlife. The potential for most recreation uses and for building site development and sanitary facilities is poor.

This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay or pasture. Seasonal wetness limits the choice of plants in some years. The wetness can be reduced by shallow ditches or by tiling. The return of crop residue to the surface layer and conservation tillage reduce compaction and soil loss.

The acreage of this soil used as pastureland or hayland is not extensive. The choice of plants is limited by wetness in some years. Restricted use during wet periods keeps the pasture and the soil in good condition.

Capability subclass IIw.

164A—Stoy silt loam, 0 to 3 percent slopes. This nearly level, somewhat poorly drained soil is on broad ridgetops, at the head of drainageways, and on foot slopes in the uplands. Individual areas are irregularly shaped or round and range from 5 to 25 acres in size.

Typically, the surface layer is brown and yellowish brown silt loam about 10 inches thick. The subsoil is about 40 inches thick. It is mainly yellowish brown silt loam or silty clay loam that has grayish mottles. The lower part is compact and brittle. The substratum to a depth of about 78 inches is brown silt loam. In places, the surface layer is dark grayish brown and the subsurface layer is grayish brown. In some areas the lower part of the subsoil is not so compact or brittle.

Included with this soil in mapping are small areas of eroded soils that have slopes of more than 3 percent and some areas on foot slopes or in depressions where local runoff has deposited sediments and the surface layer is 10 to 24 inches thick. Also included are small areas of the moderately well drained Hosmer soils on slight knolls. Included areas make up about 10 to 15 percent of this unit.

Water and air move through this soil at a slow rate, and surface runoff is slow to medium. The subsoil ranges from very strongly acid to medium acid. The surface layer is friable and can be easily tilled, but it tends to crust or puddle after hard rains. The penetration of roots and the downward movement of water are somewhat restricted by the compact and brittle lower part of the subsoil. The water table is perched 1 foot to 3 feet below the surface during rainy periods. Organic-matter content and natural fertility are low. Available water capacity is high.

Most areas are farmed. This soil has good potential for row crops, hay, and pasture and for openland and woodland wildlife habitat. The potential for trees and for most

recreation uses is fair. The potential for building site development and septic tank absorption fields is poor.

This soil is suited to corn, soybeans, grain sorghum, wheat, and grasses and legumes if adequate drainage is provided. Shallow ditches can remove excess water. In low-lying areas diversion terraces can intercept runoff from higher ground. Erosion is a hazard in the more sloping areas. Conservation tillage, terraces, and contour farming reduce soil loss. Tilth can be improved by adding crop residue or other organic material to the surface layer.

Grasses and legumes grow well if properly fertilized, limed, and maintained. Frost heaving can damage the stand in winter. It can be minimized by removing excess surface water through shallow ditches. Grazing when the soil is wet causes surface compaction and poor tilth.

This soil is moderately well suited to woodland. Some areas remain in native hardwoods. Wetness can be a problem if logging is done during rainy periods.

Sewage lagoons can be installed on this soil.

Capability subclass IIw.

180—Dupo silt loam. This nearly level, somewhat poorly drained soil is on flood plains or alluvial fans where recent silty overwash covers clayey sediments. It is generally on the protected side of the levee. Unless protected, it is subject to frequent flooding for long periods from January to June. Individual areas are irregular in shape and range from about 5 to 50 acres in size.

Typically, the surface layer is dark brown silt loam about 10 inches thick. The substratum, to a depth of about 24 inches, is dark brown, mottled silt loam. Below this is a buried surface layer of very dark gray silty clay loam about 8 inches thick. The buried subsoil extends to a depth of about 65 inches or more. It is dark brown silty clay in the upper part and grayish brown silty clay loam in the lower part. In places, mainly near Ware, the surface layer is very dark grayish brown loam. In some areas the buried surface layer is dark gray.

Included with this soil in mapping are small areas of Wakeland and Darwin soils. The poorly drained Darwin soils are in slightly depressional areas. They are clayey but are covered with a thin layer of silty overwash. Wakeland soils are in the slightly higher areas near streams or overflow channels. They are silty throughout. Included soils make up about 10 to 15 percent of this unit.

Water and air move through the silty upper part of this soil at a moderately slow rate and through the clayey part of the subsoil at a slow rate. Surface runoff is slow. The substratum and buried surface layer range from medium acid to mildly alkaline. The surface layer is friable and can be tilled easily. The penetration of roots is somewhat restricted by the underlying clayey material. The seasonal high water table is 1 foot to 3 feet below the surface during the period January through June. Organic-matter content is low, and natural fertility is medium. Available water capacity is high.

Most areas are farmed. This soil has good potential for row crops, hay, pasture, and trees and as habitat for openland and woodland wildlife. It has poor potential for most recreation uses and for building site development and sanitary facilities.

This soil is suited to corn, soybeans, grain sorghum, wheat, and grasses and legumes. Wetness is the main management concern. Excess water can be removed by shallow ditches. Subsurface tile drains connected to surface inlets can drain surface water in wet spots if outlets are available. Overflow water can be diverted by ditches or by dikes.

Pasture and hay crops grow well on this soil if excess water is removed. In undrained areas the water commonly damages the crops in winter and early in spring. Selecting plants that are tolerant of wetness limits the damage. Restricting both grazing and cutting during rainy periods keeps the soil and the crop in good condition.

Capability subclass IIw.

214B—Hosmer silt loam, 2 to 6 percent slopes. This gently sloping, moderately well drained soil is on ridgetops in the uplands. Individual areas are irregular in shape and range from about 5 to 60 acres in size.

Typically, the surface layer is dark brown silt loam about 7 inches thick. The upper 21 inches of the subsoil is brown silty clay loam and yellowish brown silt loam. The lower part is a compact and brittle fragipan that extends to a depth of about 67 inches. It is mottled yellowish brown, dark yellowish brown, and light brownish gray silty clay loam and silt loam.

Included with this soil in mapping are small areas of soils that have a steeper slope. Also included are small areas of the well drained Alford soils on knolls, small areas of the somewhat poorly drained Stoy soils at the head of drainageways or on broad ridgetops, and small depressions near sink holes where the surface layer is thick. Included areas make up about 10 to 15 percent of this unit.

Water and air move through the surface layer and the upper part of the subsoil at a moderate rate and through the fragipan at a slow rate. Surface runoff is slow to medium. The subsoil ranges from very strongly acid to medium acid. The surface layer is friable and can be easily tilled, but it tends to crust or puddle after hard rains if the surface is bare. The penetration of roots and the downward movement of water are restricted by the fragipan. The water table is perched between depths of 3 and 6 feet in March and April. Organic-matter content and natural fertility are low. Available water capacity is moderate.

Most areas are farmed. This soil has good to fair potential for row crops, hay, pasture, orchards, and vegetables. The potential is good for openland and woodland wildlife habitat. It is fair to good for building site development and poor for septic tank absorption fields.

This soil is well suited to row crops, small grain, grain sorghum, and forage crops. It is also well suited to orchards, small fruit (fig. 3), and vegetables. Controlling erosion and maintaining and improving tilth and fertility are the main management concerns. Also of concern is the moderate available water capacity. Conservation tillage, terraces, contour farming, and crop residue management reduce soil loss.

Grasses and legumes grow well on this soil. Weeds can be controlled by spraying or clipping. Proper stocking rates, pasture rotation, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is well suited to woodland. Some areas support native hardwoods. Seedlings can survive and grow well if competing vegetation is controlled. Harvesting mature trees, thinning, cutting cull trees, and weeding control plant competition. Restricted use of equipment during periods when the soil is wet helps to prevent compaction of the surface layer.

This soil is suitable as a building site (fig. 4). Precautions are needed to keep the water perched on the fragipan during wet periods from surrounding a foundation or seeping into a basement or under a road. Measures that prevent excessive erosion during construction also are needed. Because of the dense fragipan, care is needed if an area is cut and filled. Unless the fill material is compacted to the same density as the pan, the foundation is likely to crack as a result of uneven settling. The proper moisture content is needed before the fill material can be compacted properly.

Septic tank absorption fields do not function adequately because permeability is slow in the fragipan.

Capability subclass IIe.

214C2—Hosmer silt loam, 6 to 12 percent slopes, eroded. This sloping, moderately well drained soil is on ridgetops, side slopes, and foot slopes in the uplands. Areas are irregularly shaped or long and range from about 5 to 40 acres in size.

Typically, the surface layer is brown and pale brown silt loam about 7 inches thick. The subsoil is about 35 inches thick. The upper 12 inches is yellowish brown silt loam. The lower 23 inches, a fragipan, is compact and brittle silt loam. It is mainly strong brown and has grayish streaks or coatings and mottles. The substratum to a depth of about 60 inches is brown silt loam. In places the fragipan is thinner and less compact.

Included with this soil in mapping are some areas of a less sloping, slightly eroded soil on the crest of ridges, a severely eroded soil on the steeper slopes or adjacent to some drainageways, the well drained Alford soil on slight rises or knolls, and the somewhat poorly drained Stoy soil at the head of drainageways. Also included are small depressions in which the surface layer is thick. Included areas make up about 10 to 15 percent of this unit.

Water and air move through the upper part of the subsoil at a moderate rate and through the fragipan at a slow rate. Surface runoff is medium in cultivated areas. The subsoil ranges from extremely acid to strongly acid. The surface layer is friable and can be easily tilled, but it tends to crust or puddle after hard rains if the surface is bare. The penetration of roots and the downward movement of water are restricted by the fragipan. The water table is perched between depths of 3 and 6 feet in March and April. Organic-matter content and natural fertility are low. Available water capacity is moderate.

Most areas are farmed. This soil has fair potential for row crops and fair to good potential for hay, pasture, trees, or orchard crops. It has good potential for openland or woodland wildlife habitat, fair potential for building site development, and poor potential for sanitary facilities.

This soil is suited to corn, soybeans, grain sorghum, wheat, and grasses and legumes. It is also suited to orchards, small fruit, and vegetables. If the soil is cultivated, further erosion is a hazard. Terraces, contour farming, a conservation cropping system, conservation tillage, and crop residue management help reduce soil loss. Returning crop residue to the surface layer or adding other organic material helps to maintain fertility, improves tilth, and increases the rate of water intake.

Grasses and legumes are well suited to this soil. Control of competing vegetation by clipping or spraying is needed. Proper stocking rates, pasture rotation, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is well suited to woodland. Many areas support native hardwoods. Seedlings can survive and grow well if competing vegetation is controlled or removed by harvesting mature trees, thinning, cutting cull trees, and weeding. Seedlings should be planted on the contour and in some type of plant cover or in mulch to prevent excessive soil loss before they are established.

This soil is suited to building sites if proper precautions are taken to overcome the slope, the erosion hazard, and seepage. Unless fill material is compacted to the same density as the fragipan, the foundation is likely to crack as a result of uneven settling. If developments are laid out on the contour, generally less cutting and filling are needed and the erosion hazard is reduced. Seepage water directly above the fragipan can surround a foundation, enter a basement, or run under a road.

Septic tank absorption fields do not function adequately because permeability is slow through the fragipan. Sewage lagoons are suitable only if they are properly designed and installed. On sites along drainageways, this soil is generally suited to pond reservoirs.

Capability subclass IIIe.

214C3—Hosmer silty clay loam, 6 to 12 percent slopes, severely eroded. This sloping, moderately well drained soil is mainly on side slopes or adjacent to drainageways. It is severely eroded; all or nearly all of the original silt loam surface layer has been removed.

Individual areas are mainly irregular in shape and range from about 5 to 30 acres in size.

Typically, the present surface layer is mixed yellowish brown and dark yellowish brown silty clay loam about 5 inches thick. The upper 10 inches of the subsoil is brown silty clay loam. The lower part to a depth of about 60 inches is a fragipan. It is brown and strong brown, very firm and brittle silt loam that has grayish mottles and streaks. In some areas the fragipan is thinner and less compact.

Included with this soil in mapping are small areas of the somewhat poorly drained Stoy soil at the head of drainageways and the well drained Alford soil on crests between drainageways. Also included are some areas of a less sloping, less eroded soil between drainageways, a few areas where gullies have formed, and, along many drainageways, a somewhat poorly drained soil that has a thickened surface layer. Included areas make up about 10 to 15 percent of this unit.

Water and air move through the surface layer and the upper part of the subsoil at a moderate rate and through the fragipan at a slow rate. The subsoil ranges from extremely acid to strongly acid. Root penetration and the downward movement of water are restricted by the fragipan. The water table is perched between depths of 3 and 6 feet in March and April. The surface layer is somewhat clayey and is difficult to till. It crusts or is hard when dry. Clods form if the soil is worked when wet. Organic-matter content and natural fertility are low. Surface runoff is rapid in cultivated areas. Evaporation is high, and available water capacity is low to moderate. The soil is somewhat droughty during dry periods.

Most areas are farmed. This soil has poor potential for cultivated crops. It has fair potential for hay, pasture, orchards and other trees, and openland or woodland wildlife habitat. The potential for building site development is fair, and the potential for sanitary facilities is poor.

This soil is suited to corn, soybeans, and grain sorghum if adequate precautions are taken to control further soil loss. Managing water and maintaining fertility and the content of organic matter also are concerns. A conservation cropping system, conservation tillage, contour farming, terraces, and crop residue management help to reduce runoff, control erosion, and increase the rate of water intake. Grassed waterways are needed in many areas to safely convey runoff downslope. Returning crop residue to the soil or regularly adding other organic material helps to maintain fertility, reduces crusting, and increases the infiltration rate.

Grasses and legumes grow well if properly fertilized and maintained. Establishment is difficult because tilth is poor. Many stands are spotty. Carefully preparing a seedbed and maintaining a high level of fertility help in establishing a stand. Proper stocking rates, pasture rotation, weed control, and restricted use during wet periods help to maintain an adequate stand.

Some areas are brushland, and some support planted pines. This soil is well suited to woodland. Seedlings can survive and grow well if competing vegetation is controlled by harvesting mature trees, thinning, cutting cull trees, and weeding. Restricting the use of equipment when the soil is wet helps to prevent compaction of the surface layer.

Some idle areas that formerly were cultivated have revegetated naturally. As a result, they are adequately protected against erosion. Many of these areas produce plants that are a source of food and cover for openland wildlife. Food plots of grain sorghum, sunflowers, lespedeza, or other plants increase wildlife populations. Applications of fertilizer are needed.

This soil is suited as a building site if proper precautions are taken to overcome the slope, the erosion hazard, and seepage. Cutting and filling or shaping is needed in many areas. Unless the fill material is compacted to the same density as the fragipan, the foundation is likely to crack as a result of uneven settling. Establishing lawn grasses or other plant cover is difficult because tilth is poor. Many stands are spotty. Careful seedbed preparation, mulch and netting, a nurse crop, and maintenance of a high level of fertility help to establish a stand.

Septic tank absorption fields generally do not function adequately because permeability is slow in the fragipan. Installing sewage lagoons is difficult because of the slope. On sites along drainageways, this soil is suited to pond reservoirs.

Capability subclass IVe.

214D2—Hosmer silt loam, 12 to 18 percent slopes, eroded. This strongly sloping, moderately well drained soil is mainly on side slopes along drainageways or bottom land. In a few areas it is on convex ridgetops and foot slopes. Individual areas are mainly long and range from about 5 to 30 acres in size.

Typically, the surface layer is dark yellowish brown and yellowish brown silt loam about 7 inches thick. The upper 14 inches of the subsoil is yellowish brown silt loam. The lower 31 inches is a fragipan. It is compact and brittle, strong brown silt loam that has grayish streaks and mottles. The substratum to a depth of about 65 inches is brown silt loam. In places, the upper part of the subsoil is thicker and the fragipan is thinner and less compact. In many wooded areas the surface layer is darker.

Included with this soil in mapping are narrow areas of Zanesville soils along the lower part of many side slopes. These soils formed partly in material weathered from bedrock. In a few of these areas the surface is stony. Also included are somewhat poorly drained soils, along many of the drainageways, that have a thickened surface layer; a few severely eroded spots along drainageways or at the crest of slopes; small areas of the somewhat poorly drained Stoy soils on foot slopes along

drainageways or at the break of slopes; and small areas of the well drained Alford soil on some side slopes and ridgetops. Included areas make up about 10 to 15 percent of this unit.

Water and air move through the surface layer and the upper part of the subsoil at a moderate rate and through the fragipan at a slow rate. Surface runoff is rapid. The subsoil ranges from strongly acid to extremely acid. The water table is perched between depths of 3 and 6 feet in March and April. The surface layer is friable and can be tilled easily. It tends to crust or puddle, however, after hard rains, especially in areas where the plow layer contains subsoil material. Organic-matter content and natural fertility are low. Available water capacity is moderate.

Most areas are pastured or support native hardwoods. This soil has poor potential for cultivated crops and fair to good potential for hay, pasture, orchards, or woodland. The potential for most recreation uses and for building site development and sanitary facilities is poor. The potential for openland or woodland wildlife habitat is good to fair.

This soil is poorly suited to corn, soybeans, and grain sorghum. Air drainage generally is good, and the soil is suited to fruit trees if an adequate plant cover is maintained. In cultivated areas further erosion is a hazard. A conservation cropping system, terraces, conservation tillage, contour farming, and crop residue management help to prevent excessive soil loss. Grassed waterways are needed in many areas to safely convey runoff downslope. Crop residue and mulch improve tilth, increase the rate of water intake, and reduce evaporation.

In most areas this soil is well suited to pasture or hayland. Proper stocking rates, rotation grazing, and exclusion of livestock when the soil is wet keep the stand and the soil in good condition and help to control erosion.

This soil is well suited to woodland. Some areas remain in native hardwoods. Only a few limitations or hazards are of concern when the trees are planted or harvested. Planting seedlings on the contour and in a mulch or a cover crop helps to prevent excessive soil losses before the seedlings are established. Plant competition can be controlled by harvesting mature trees, cutting cull trees, thinning, and weeding. Restricting the use of equipment when the soil is wet helps to prevent compaction of the surface layer.

The slope and the erosion hazard limit the use of this soil as a site for buildings, local roads and streets, and waste disposal systems. On sites along drainageways, the soil is generally suited to pond reservoirs.

Capability subclass IVe.

214D3—Hosmer silty clay loam, 12 to 18 percent slopes, severely eroded. This strongly sloping, moderately well drained soil is on side slopes above steeper soils and along drainageways or bottom land. It is severely eroded; all or nearly all of the original silt loam surface layer has been removed. Individual areas are irregularly shaped or long and range from about 5 to 100 acres in size.

Typically, the present surface layer is yellowish brown silty clay loam about 5 inches thick. The upper 7 inches of the subsoil is yellowish brown silty clay loam. The lower 32 inches is a compact and brittle fragipan. It is yellowish brown and brown silt loam that has grayish streaks and mottles. The substratum to a depth of about 60 inches is brown silt loam. In places, the upper part of the subsoil is thicker and the fragipan is thinner and less compact.

Included with this soil in mapping are narrow strips of Zanesville soils along some of the lower slopes and drainageways. These soils formed partly in material weathered from bedrock. In some of these areas the surface is stony. Also included are somewhat poorly drained soils, along many of the drainageways, that have a thickened surface layer; small areas of the well drained Alford soil and a less sloping, less eroded Hosmer soil between drainageways; and some areas where gullies have formed. Included areas make up about 10 to 15 percent of this unit.

Water and air move through the upper part of the subsoil at a moderate rate and through the fragipan at a slow rate. The subsoil ranges from strongly acid to extremely acid. The surface layer is low in content of organic matter and somewhat clayey. It clods if it is worked when wet, and it is hard when dry. It tends to puddle and crust after hard rains. The penetration of roots and the downward movement of water are restricted by the fragipan. The water table is perched between depths of 3 and 6 feet in March and April. Natural fertility is low. Surface runoff is rapid, evaporation is high, and available water capacity is low to moderate. The soil is somewhat droughty during dry spells. It is somewhat more droughty on slopes facing southwest than on slopes facing northeast.

Most areas have been cultivated, but many areas are now pastureland or idle cropland. This soil has poor potential for cultivated crops and fair potential for hay, pasture, or trees. The potential is fair for openland wildlife habitat and good for woodland wildlife habitat. It is poor for recreation uses and for building site development and sanitary facilities.

This soil generally is not suited to cultivated crops. It is suitable as pastureland and hayland. Applications of fertilizer, proper stocking rates, pasture rotation, weed control, and restricted use during wet periods maintain an adequate stand, keep the soil in good condition, and help to control erosion.

This soil is suited to woodland. Seedlings should be planted on the contour and in a plant cover or in mulch to prevent additional erosion before they are established.

Many areas of idle cropland that has naturally revegetated provide food and cover for a variety of openland wildlife. Planting could greatly improve these areas as

habitat for openland or woodland wildlife. Applications of the proper kind and amount of fertilizer are needed.

The slope and the erosion hazard severely limit the use of this soil as a site for buildings, local roads, and waste disposal systems. On sites along drainageways, the soil is generally suited to pond reservoirs.

Capability subclass VIe.

214E—Hosmer silt loam, 18 to 30 percent slopes. This moderately steep, moderately well drained soil is on side slopes or hillsides above steeper soils or along drainageways or bottom land. Individual areas are mainly long and range from about 5 to 100 acres in size.

Typically, the surface layer is 3 inches of dark brown silt loam. The subsurface layer is 4 inches of pale brown silt loam. The upper 16 inches of the subsoil is yellowish brown silty clay loam. The lower 28 inches is a compact and brittle fragipan. It is strong brown silt loam that has grayish streaks and mottles. The substratum to a depth of about 60 inches is brown silt loam. In places, the upper part of the subsoil is thicker and the fragipan is thinner and less compact.

Included with this soil in mapping are narrow strips of Zanesville soils along some of the lower slopes and drainageways. These soils formed partly in material weathered from bedrock. In some of these areas the surface is stony. Also included are somewhat poorly drained soils, along many drainageways, that have a thickened surface layer and areas of the well drained Alford soils and of severely eroded soils, mainly along drainageways or at the crest of slopes. Included areas make up about 10 to 15 percent of this unit.

Water and air move through the surface layer and the upper part of the subsoil at a moderate rate and through the fragipan at a slow rate. Surface runoff is rapid. The subsoil ranges from strongly acid to extremely acid. The surface layer is friable. The penetration of roots and the downward movement of water are restricted by the fragipan. The water table is perched between depths of 3 and 6 feet in March and April. Natural fertility and organic-matter content are low. Available water capacity is moderate. Somewhat less water is available to plants on slopes facing southwest than on slopes facing northeast.

Most areas are woodland or pasture. This soil generally is not suited to cultivated crops. It has fair potential for pasture, hayland, wildlife habitat, and orchards. The potential for building site development, sanitary facilities, and recreation uses is poor.

This soil is suited to fruit trees if erosion is controlled by an adequate plant cover. Air drainage generally is good. Care is needed in the use of equipment because the soil is moderately steep.

This soil is suitable as pastureland. Control of competing vegetation by clipping or spraying is needed. Proper stocking rates, pasture rotation, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is well suited to woodland. Many areas support native hardwoods. Seedlings can survive and grow well if competing vegetation is controlled or removed by harvesting mature trees, thinning, weeding, and cutting cull trees. Seedlings should be planted on the contour and in some type of plant cover or mulch to prevent excessive soil loss before they are established.

This soil generally is not suitable as a site for buildings, local roads and streets, and waste disposal systems. The hazard of erosion is severe. Special design, layout, and construction methods are needed.

Capability subclass VIe.

214E3—Hosmer silty clay loam, 18 to 30 percent slopes, severely eroded. This moderately steep, moderately well drained soil is on side slopes or hillsides above steeper soils or along drainageways or bottom land. It is severely eroded; all or nearly all of the original silt loam surface layer has been removed. Individual areas are mainly long and range from about 15 to 80 acres in size.

Typically, the surface layer is yellowish brown silty clay loam about 3 inches thick. The upper 12 inches of the subsoil is yellowish brown silty clay loam. The lower 29 inches is a dense and brittle fragipan. It is yellowish brown and strong brown silt loam that has grayish mottles and streaks. The substratum to a depth of about 60 inches is brown silt loam. In places, the upper part of the subsoil is thicker and the fragipan is thinner and less dense.

Included with this soil in mapping are narrow strips of Zanesville soils along some of the lower slopes and drainageways. These soils formed partly in material weathered from bedrock. In some of these areas the surface is stony. Also included are somewhat poorly drained soils, along many drainageways, that have a thickened surface layer; some areas of a less sloping, less eroded soil between drainageways; and a few areas of the well drained Alford soil. Included areas make up about 10 to 15 percent of this unit.

Water and air move through the surface layer and the upper part of the subsoil at a moderate rate and through the fragipan at a slow rate. The subsoil ranges from strongly acid to extremely acid. Organic-matter content and natural fertility are low. The penetration of roots and the downward movement of water are restricted by the fragipan. The water table is perched between depths of 3 and 6 feet in March and April. Surface runoff is rapid, the evaporation rate is high, and available water capacity is low to moderate. The soil is droughty during dry periods. It is more droughty on slopes facing southwest than on slopes facing northeast.

Most areas are idle cropland or pasture that formerly was cultivated. Some areas are cultivated. This soil generally is not suited to cultivated crops. It has fair potential for pasture, wildlife habitat, orchards, and woodland. It

has poor potential for most recreation uses, building site development, and sanitary facilities.

This soil is suited to fruit trees if erosion is controlled by an adequate plant cover. Air drainage is good. Care is needed in the use of equipment because the soil is moderately steep.

This soil is suitable as pastureland. Proper stocking rates, pasture rotation, weed control, and restricted use during wet periods maintain an adequate stand, keep the soil in good condition, and reduce soil loss.

Many areas of idle cropland that has naturally revegetated provide food and cover for a variety of openland wildlife. Planting could greatly improve these areas as habitat for openland or woodland wildlife. Applications of the proper kind and amount of fertilizer are needed.

This soil is suited to woodland. Some areas are reverting to native hardwoods. A few areas have been planted to pines. The erosion hazard, the equipment limitation, and plant competition are problems if the soil is used as woodland. Further erosion is a serious problem when trees are planted in new stands. Seedlings should be planted on the contour and in a plant cover or mulch to prevent additional erosion before they are established. Harvesting mature trees, thinning, cutting cull trees, and weeding reduce plant competition. Care is needed in the use of equipment because the soil is moderately steep.

This soil generally is not suited as a site for buildings, local roads and streets, and waste disposal systems. The hazard of erosion is severe. Special design, layout, and construction methods are needed. They may be too costly.

Capability subclass VIIe.

284A—Tice silty clay loam, 0 to 3 percent slopes. This nearly level, somewhat poorly drained soil is on broad flats or in other areas on the flood plain of the Mississippi River. It is on the protected side of the levee and is subject to rare flooding. Individual areas are round or long and range from about 5 to 30 acres in size.

Typically, the surface layer is very dark grayish brown silty clay loam about 11 inches thick. The subsoil is about 37 inches thick. It is mainly dark grayish brown, mottled silty clay loam in the upper part and dark grayish brown clay loam in the lower part. The substratum to a depth of about 60 inches is dark brown clay loam. In places loamy strata are in the lower part of the subsoil and in the substratum.

Included with this soil in mapping are a few areas along overflow channels where loamy overwash is evident and small depressional areas of the more clayey Cairo and Darwin soils. Also included, on slight rises, are areas of Medway soils, which contain more sand within a depth of 40 inches than this Tice soil. Included areas make up about 5 to 15 percent of this unit.

Water and air move through this soil at a moderate rate. Surface runoff is slow. Because the soil is in a low-lying position on the landscape, the seasonal high water table is 1 foot to 3 feet below the surface during most years. The subsoil ranges from slightly acid to mildly alkaline. The surface layer is somewhat clayey and firm. Organic-matter content is moderate, and natural fertility is high. Available water capacity also is high.

Most areas are used for cultivated crops. This soil has good potential for cultivated crops, hay, pasture, trees, and openland and woodland wildlife habitat. It has fair potential for most recreation uses and poor potential for building site development and sanitary facilities.

This soil is suited to corn, grain sorghum, soybeans, and wheat; to speciality crops, such as pumpkins or sunflowers; and to grasses and legumes. Shallow surface ditches or tiling can provide drainage. Erosion is a hazard in the more sloping areas. Conservation tillage and crop residue management help to reduce soil loss.

This soil is generally unsuited to building site development and onsite waste disposal systems because of seasonal wetness and the hazards of overflow and frost action.

Capability class I.

308B2—Alford silt loam, 2 to 6 percent slopes, eroded. This gently sloping, well drained soil is on ridgetops and knolls in the uplands. Individual areas are mainly irregular in shape and range from about 5 to 50 acres in size.

Typically, the surface layer is about 8 inches of dark brown silt loam. The subsoil is about 55 inches thick. It is brown and strong brown silty clay loam in the upper part and yellowish brown silt loam in the lower part. The substratum to a depth of about 70 inches is brown silt loam. In some areas a thin, compact and brittle layer is in the lower part of the subsoil. This layer has grayish mottles and streaks. In some areas at the head of drainageways or the crest of slopes, the soil is severely eroded.

Included with this soil in mapping are small areas of the moderately well drained Hosmer soils at the head of drainageways and on some of the broader ridgetops. These soils make up about 10 to 15 percent of this unit.

Water and air move through this soil at a moderate rate, and surface runoff is slow to medium. The subsoil ranges from medium acid to very strongly acid. The surface layer is friable and can be easily tilled, but it tends to crust or puddle after hard rains if the surface is bare. Organic-matter content is low, and natural fertility is medium. Available water capacity is high. Plant roots readily penetrate the soil.

Most areas are used for cultivated crops, hay and pasture, or orchards. This soil has good potential for those uses, for woodland, for openland or woodland wildlife habitat, and for recreation uses. It has fair potential for building site development and good potential for septic tank absorption fields.

This soil is suited to row crops, vegetables (fig. 5), and fruit trees. Controlling erosion is the main problem. Ter-

races, contour farming, a conservation cropping system, conservation tillage, and crop residue management help to reduce soil loss. Returning crop residue to the surface layer or adding other organic material reduces crusting and increases the rate of water intake.

Hay and pasture crops are well suited to this soil. They are effective in controlling erosion. Proper stocking rates, pasture rotation, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is very well suited to woodland. Seedlings can survive and grow well if competing vegetation is controlled by harvesting mature trees, cutting cull trees, thinning, and seeding. Restricting the use of equipment when the soil is wet helps to prevent compaction of the surface layer.

This soil is well suited to most recreation uses. In many areas it is on high linear ridges adjacent to steeper, commonly wooded soils on hillsides. This setting is favorable for camp and picnic areas, playgrounds, and hiking trails. Cutting and filling are needed to make some areas level enough for playgrounds and similar recreation uses. Care is needed to keep concentrated runoff from forming gullies in the adjacent steeper soils.

This soil has few limitations as a site for buildings, local roads, and waste disposal systems that are properly designed.

Capability subclass IIe.

308C2—Alford silt loam, 6 to 12 percent slopes, eroded. This sloping, well drained soil is on convex ridgetops and on side slopes above steeper slopes or adjacent to drainageways. Individual areas are long or irregularly shaped. Most range from about 5 to 100 acres in size.

Typically, the surface layer is dark brown silt loam about 6 inches thick. The subsoil is strong brown silty clay loam about 47 inches thick. The substratum to a depth of about 70 inches is brown silt loam. In some areas a thin, compact and brittle layer is in the lower part of the subsoil. This layer has grayish streaks and mottles. In wooded areas a dominantly very dark grayish brown surface layer overlies a brown subsurface layer. On the crest of some ridges, the soil is less sloping and only slightly eroded. In some areas on steeper slopes or adjacent to drainageways, it is severely eroded.

Included with this soil in mapping are small areas of the moderately well drained Hosmer soils near the head of drainageways and on some of the broader ridgetops. Also included, on some conical slopes and in the accompanying depressions, are areas where the surface layer is thick. Included areas make up about 10 to 15 percent of this unit.

Water and air move through this soil at a moderate rate, and surface runoff is medium. The subsoil ranges from medium acid to very strongly acid. The surface layer is friable and can be easily tilled, but it tends to crust or puddle after a hard rain if the surface is bare. Organic-matter content is low in the surface layer, and natural fertility is medium. Available water capacity is high. Plant roots readily penetrate this soil.

Most of the broader areas are farmed, but many areas are pasture or woodland. This soil has good potential for row crops, hay, pasture, orchards, woodland, and openland or woodland wildlife habitat. The potential for most recreation uses, for building site development, and for septic tank absorption fields is fair.

This soil is suited to corn, soybeans, grain sorghum, wheat, and grasses and legumes. It is well suited to orchards and to most small fruit and vegetable crops. Further erosion is a hazard. Conservation tillage, a conservation cropping system, terraces, contour farming, and crop residue management help to prevent excessive surface runoff and soil loss. Grassed waterways are needed in many areas to convey runoff downslope. Crusting can be reduced by returning crop residue to the surface layer or adding other organic material.

This soil is well suited as pastureland and hayland. Control of competing vegetation by clipping or spraying is needed. Proper stocking rates, pasture rotation, and restricted use during wet periods help to keep the pasture and the soil in good condition.

Some areas remain in native hardwoods. This soil is very well suited to woodland. Seedlings can survive and grow well if competing vegetation is controlled by harvesting mature trees, thinning, cutting cull trees, and weeding. Restricting the use of equipment when the soil is wet helps to prevent compaction of the surface layer.

This soil is suited to many recreation uses. Cutting and filling are needed in some areas. Care is needed to keep concentrated runoff from forming gullies in the adjacent, generally much steeper soils.

This soil is suited as a site for buildings, local roads and streets, and waste disposal systems that are properly designed and laid out. The slope, the erosion hazard, the shrink-swell potential, and the possible frost action are the main concerns. On sites along drainageways, the soil is generally suited to pond reservoirs.

Capability subclass IIIe.

308C3—Alford silty clay loam, 6 to 12 percent slopes, severely eroded. This sloping, severely eroded, well drained soil is on side slopes above steeper slopes and adjacent to drainageways. Erosion has removed all or nearly all of the original silt loam surface layer. Individual areas are mainly long or irregularly shaped and range from about 5 to 60 acres in size.

Typically, the surface layer is yellowish brown silty clay loam about 6 inches thick. The subsoil is about 42 inches thick. It is strong brown silty clay loam and silt loam. The substratum to a depth of about 60 inches is yellowish brown silt loam. In some areas a thin, compact and brittle layer is in the lower part of the subsoil. In

some areas between drainageways, the soil is less sloping and less eroded.

Included with this soil in mapping are small areas of the moderately well drained Hosmer soils, which are mainly along drainageways, and the somewhat poorly drained Wakeland soils, which have a thickened surface layer. The Wakeland soils are along many narrow drainageways. Also included are soils on conical slopes and in the accompanying depressions. These soils have a thick surface layer. Included soils make up about 8 to 12 percent of this unit.

Water and air move through this soil at a moderate rate. Surface runoff is rapid in cultivated areas. The subsoil ranges from medium acid to very strongly acid. The surface layer is somewhat clayey and is difficult to work. It is hard when dry and clods if worked when wet. Organic-matter content is low in the surface layer. Natural fertility is medium. Available water capacity is high.

Most areas are farmed. This soil has fair potential for cultivated crops and fair to good potential for pasture, hay, orchards, and woodland. It has fair potential for most recreation uses, for openland or woodland wildlife habitat, and for building site development and septic tank absorption fields.

This soil is suited to corn, grain sorghum, soybeans, wheat, and vegetables or fruit. In cultivated areas erosion is a serious hazard. A conservation cropping system, terraces, contour farming, crop residue management, and conservation tillage help to reduce runoff, control erosion, and increase the rate of water intake. Grassed waterways are needed in many areas to safely convey runoff downslope.

This soil is suitable as pastureland (fig. 6) and hayland. Establishing the plants is difficult because tilth is poor. Proper stocking rates, pasture rotation, weed control, and restricted use during wet periods help to maintain an adequate stand.

Some formerly cultivated areas are now brushland, and some have been planted to pines. This soil is well suited to woodland. Seedlings can survive and grow well if competing vegetation is controlled by harvesting mature trees, thinning, cutting cull trees, and weeding. They should be planted on the contour and in a plant cover or mulch to control erosion before they are established. Restricting the use of equipment when the soil is wet helps to prevent compaction of the surface layer.

Some idle areas that formerly were cultivated have revegetated naturally and are adequately protected against erosion. Many of these areas produce plants that are a source of food and cover for openland or woodland wildlife.

This soil is suited as a site for buildings, local roads and streets, and waste disposal systems only if the slope, surface runoff, shrink-swell potential, frost hazard, and erosion hazard are overcome. Cutting and filling or shaping is needed in many areas. Care is needed when the fill material is compacted.

Capability subclass IVe.

308D2—Alford silt loam, 12 to 18 percent slopes, eroded. This strongly sloping, well drained soil is mainly on hillsides above steeper soils or adjacent to drainageways or bottom land. Individual areas are mainly long or irregularly shaped and range from about 5 to 60 acres in size.

Typically, the surface layer is dark brown and dark yellowish brown silt loam about 5 inches thick. The subsoil is mainly yellowish brown silty clay loam about 47 inches thick. The substratum to a depth of about 60 inches is dark yellowish brown silt loam. In places a thin, compact and brittle layer is in the lower part of the subsoil. It has grayish streaks and mottles. In wooded areas a dominantly very dark grayish brown surface layer overlies a brown subsurface layer. A few severely eroded spots are along drainageways or at the crest of slopes.

Included with this soil in mapping are narrow areas of Wellston or Baxter soils along the lower part of many side slopes and areas of the somewhat poorly drained Wakeland soils along many narrow drainageways. The Wellston and Baxter soils formed partly in material weathered from bedrock. In many areas they have a stony surface. The Wakeland soils have a thickened surface layer. Also included are soils on conical slopes and in the accompanying depressions. These soils have a thick surface layer. Included soils make up about 10 to 15 percent of this unit.

Water and air move through this soil at a moderate rate, and surface runoff is medium to rapid. The subsoil ranges from medium acid to very strongly acid. The surface layer is friable and can be easily tilled, but it tends to crust or puddle after hard rains if the surface is bare. Organic-matter content is low in the surface layer. Natural fertility is medium. Available water capacity is high. Plant roots readily penetrate this soil.

Most areas remain in native hardwoods or are pastured. This soil has poor potential for cultivated crops and good potential for hay, pasture, or woodland. It has poor potential for most recreation uses and good potential for woodland wildlife habitat. The potential for building site development and sanitary facilities is poor.

This soil is poorly suited to corn, soybeans, grain sorghum, and wheat. It is suited to grasses and legumes. It is also suited to most orchard and small fruit crops. If the soil is cultivated, further erosion is a hazard. A conservation cropping system, terraces, conservation tillage, contour farming, and crop residue management help to prevent excessive runoff and soil loss. Grassed waterways are needed in many areas to convey runoff downslope. Crusting can be reduced by returning crop residue to the surface layer or adding other organic material.

This soil is well suited as pastureland. A cover of pasture plants is effective in controlling erosion. Control of competing vegetation by clipping or spraying is

needed. Proper stocking rates, pasture rotation, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is very well suited to woodland. Plant competition can be controlled by harvesting mature trees, thinning, cutting cull trees, and weeding. Seedlings should be planted on the contour and in a plant cover or mulch to prevent excessive soil loss before they are established. Restricting the use of equipment when the soil is wet helps to prevent compaction of the surface layer.

The slope and the erosion hazard limit the use of this soil as a site for buildings, local roads and streets, and waste disposal systems. Extensive cutting and filling or shaping generally is needed.

Capability subclass IVe.

308D3—Alford silty clay loam, 12 to 18 percent slopes, severely eroded. This strongly sloping, severely eroded, well drained soil is mainly on hillsides above steeper soils or adjacent to drainageways or bottom land. Erosion has removed all or nearly all of the original silt loam surface layer. Individual areas are long or irregularly shaped and range from about 5 to 80 acres in size.

Typically, the surface layer is dark brown silty clay loam about 5 inches thick. The subsoil is strong brown silty clay loam about 45 inches thick. The substratum to a depth of about 60 inches is dark yellowish brown silt loam. In places a thin, compact and brittle layer is in the lower part of the subsoil. It has grayish streaks and mottles. Some areas between drainageways are less sloping and less eroded.

Included with this soil in mapping are areas of the moderately well drained Hosmer soils, narrow strips of Wellston or Baxter soils along some of the lower slopes and drainageways, areas of the somewhat poorly drained Wakeland soils along many narrow drainageways, and areas where gullies have formed. The Wellston and Baxter soils formed partly in material weathered from bedrock. In many areas they have a stony surface. The Wakeland soils have a thickened surface layer. Also included are soils on conical slopes and in the accompanying depressions. These soils have a thick surface layer. Included areas make up about 10 to 15 percent of this unit.

Water and air move through this soil at a moderate rate. Surface runoff is rapid. The subsoil ranges from medium acid to very strongly acid. The surface layer is low in content of organic matter and is somewhat clayey. It clods if worked when wet, and it is hard when dry. It tends to puddle and crust after hard rains. Natural fertility is medium. Available water capacity is high. Plant roots readily penetrate the soil.

Most areas have been cultivated. This soil has poor potential for cultivated crops. It has fair to good potential for hay, pasture, orchards, and woodland. The potential for woodland wildlife habitat is good. The potential for most recreation uses and for building site development and sanitary facilities is poor.

This soil is not suited to cultivated crops. It is suited to fruit trees if an adequate plant cover is maintained to control further soil loss. Air drainage generally is good.

This soil is suitable as pastureland. Preparing a seedbed for pasture plants and establishing a stand are difficult because of surface crusting and runoff. Proper stocking rates, pasture rotation, weed control, and restricted use during wet periods help to maintain an adequate stand.

Some formerly cultivated areas are reverting to native hardwoods, and a few have been planted to pines. This soil is very well suited to woodland. Seedlings can survive and grow well if competing vegetation is controlled by thinning, cutting cull trees, and weeding. They should be planted on the contour and in a plant cover or mulch to prevent additional erosion before they are established. Restricting the use of equipment when the soil is wet helps to prevent compaction of the surface layer.

Some areas of idle cropland that has naturally revegetated provide food and cover for a variety of openland wildlife. If the proper kind and amount of fertilizer is applied, planting can greatly improve these areas as wildlife habitat. The wooded areas provide good habitat for woodland wildlife.

The slope and the erosion hazard severely limit the use of this soil as a site for buildings, local roads, and waste disposal systems. Extensive cutting and filling or shaping commonly is needed.

Capability subclass VIe.

308E—Alford silt loam, 18 to 30 percent slopes. This moderately steep, well drained soil is mainly on hillsides adjacent to drainageways or bottom land. Individual areas are long or irregularly shaped and range from about 5 to 100 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 2 inches thick. The subsurface layer is yellowish brown silt loam about 6 inches thick. The subsoil is strong brown silty clay loam about 52 inches thick. The substratum to a depth of about 70 inches is brown silt loam. In places a thin, compact and brittle layer is in the lower part of the subsoil. It has grayish streaks and mottles.

Included with this soil in mapping are narrow strips of Wellston or Baxter soils along some of the lower slopes and drainageways. These soils formed partly in material weathered from bedrock. In many areas they have a stony surface. Also included are small areas of the moderately well drained Hosmer soils near the crest of slopes and along some drainageways and areas of the somewhat poorly drained Wakeland soils along many narrow drainageways. The Wakeland soils have a thickened surface layer. Included soils make up about 10 to 15 percent of this unit.

Water and air move through this soil at a moderate rate, and surface runoff is rapid. The subsoil ranges from medium acid to very strongly acid. The surface layer is friable and can be tilled easily. Organic-matter content is low, and natural fertility is medium. Available water capacity is high. Plant roots readily penetrate the soil.

Most areas support native hardwoods. This soil is generally unsuited to cultivated crops. It has fair potential for pasture and orchards and good potential for woodland and for woodland wildlife habitat. The potential for most recreation uses and for building site development and sanitary facilities is poor.

This soil is suited to fruit trees if the plant cover adequately controls erosion. Air drainage generally is good. Care is needed when equipment is used because the soil is moderately steep.

This soil is suitable as pastureland. Control of competing vegetation by clipping or spraying is needed. Proper stocking rates, pasture rotation, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is very well suited to woodland. Many areas support native hardwoods (fig. 7). Seedlings can survive and grow well if competing vegetation is controlled or removed by harvesting mature trees, thinning, cutting cull trees, and weeding. They should be planted on contour and in some type of plant cover or mulch to prevent excessive soil loss before they are established. Restricting the use of equipment when the soil is wet helps to prevent compaction of the surface layer. Care is needed when equipment is used because the soil is moderately steep.

This soil is suited to either openland or woodland wildlife habitat. It can support a variety of native or introduced woody and herbaceous plants.

Because it is moderately steep, this soil is generally unsuited as a site for buildings, local roads and streets, and waste disposal systems. Extensive cutting and filling or shaping generally is needed. The hazard of erosion is severe. Special design, layout, and construction methods are needed. The cost may be prohibitive.

Capability subclass VIe.

308E3—Alford silty clay loam, 18 to 30 percent slopes, severely eroded. This moderately steep, severely eroded, well drained soil is on hillsides adjacent to drainageways or bottom land. Individual areas are long or irregularly shaped and range from about 10 to 60 acres in size.

Typically, the surface layer is brown silty clay loam about 3 inches thick. The subsoil is about 42 inches of strong brown silty clay loam and silt loam. The substratum to a depth of about 60 inches is brown silt loam. In places a thin, compact and brittle layer is in the lower part of the subsoil. It has grayish streaks and mottles. In some areas between drainageways, the soil is less sloping and less eroded.

Included with this soil in mapping are narrow strips of Wellston or Baxter soils along some of the lower slopes and along drainageways. These soils formed partly in material weathered from bedrock. In some areas they have a stony surface. Also included are a few areas of the moderately well drained Hosmer soils and, along many narrow drainageways, areas of the somewhat poorly drained Wakeland soils, which have a thickened surface layer. Included soils make up about 10 to 15 percent of this unit.

Water and air move through this soil at a moderate rate. Surface runoff is rapid. The subsoil ranges from medium acid to very strongly acid. The surface layer is low in content of organic matter and is somewhat clayey. It clods if worked when wet, and it is hard when dry. It tends to puddle or crust after hard rains. Natural fertility is medium. Available water capacity is high.

This soil generally has been cultivated, but most areas are now idle cropland or pasture. A few areas are cultivated. The soil is not suited to cultivated crops. It has fair potential for pasture, wildlife habitat, orchards, and woodland. It has poor potential for most recreation uses, building site development, and sanitary facilities.

This soil is suited to fruit trees if an adequate plant cover is maintained to control further erosion. Air drainage is good. Care is needed when equipment is used because the soil is moderately steep.

This soil is suitable as pastureland. Preparing a seedbed, however, is difficult, and many stands are spotty. Proper stocking rates, pasture rotation, weed control, and restricted use during wet periods help to maintain an adequate stand.

Many formerly cropped areas that have naturally revegetated provide food and cover for a variety of openland wildlife. If the proper kind and amount of fertilizer is applied, planting can greatly improve these areas as wildlife habitat.

This soil is very well suited to woodland. Some areas are reverting to native hardwoods. A few have been planted to pines. The erosion hazard, the equipment limitation, and plant competition are the main problems in managing the soil as woodland. Erosion can be a serious problem when new stands are planted. Seedlings should be planted on the contour and in a plant cover or mulch to prevent excessive erosion before they are established. Harvesting mature trees, thinning, cutting cull trees, and weeding reduce plant competition. Care is needed when equipment is used because the soil is moderately steep.

Because of the moderately steep slope, this soil is generally not suited as a site for buildings, local roads and streets, and waste disposal systems. Extensive cutting and filling or extensive shaping is needed in many areas. Erosion is a severe hazard, and establishing vegetation is difficult in bare areas. Special design, layout, and construction methods are needed if buildings are constructed. The cost may be prohibitive.

Capability subclass VIe.

331—Haymond silt loam. This nearly level, well drained soil is on flood plains and alluvial fans along streams. It is subject to rare flooding. Individual areas are mainly long and range from about 5 to 75 acres in size.

Typically, the surface layer is dark brown silt loam about 10 inches thick. The subsurface layer is brown silt loam about 10 inches thick. The substratum to a depth of about 62 inches is yellowish brown silt loam. Few or common grayish mottles are below a depth of 30 inches in places. In several areas the lower part of the substratum contains cherty, gravelly, or channery fragments.

Included with this soil in mapping is the somewhat poorly drained Wakeland soil in small, slightly depressional areas. Also included, along streams or overflow channels, are areas of Elsah and Burnside soils, which are cherty or channery within a depth of 25 inches. Included soils make up about 5 to 15 percent of this unit.

Water and air move through this soil at a moderate rate, and surface runoff is slow. Reaction ranges from medium acid to neutral throughout. The surface layer is friable or very friable and can be tilled easily. Organic-matter content is low in the surface layer. Natural fertility is medium or high. Available water capacity is very high. Plant roots readily penetrate this soil.

Most of the broader areas on bottom land are cultivated, but some areas are pastured or support trees. This soil has good potential for cultivated crops, hay, pasture, trees, and openland or woodland wildlife habitat. The potential for all recreation areas but campsites is good. The potential for building site development and sanitary facilities is poor.

This soil is suited to corn, soybeans, grain sorghum, small grain, grasses, legumes, and most vegetables. Flash flooding and the associated deposition and streambank cutting or scouring are the main concerns. Levees and adequate channels reduce the flood hazard. Diversions are needed in some areas to intercept the runoff from higher lying areas. Returning crop residue to the soil or regularly adding other organic material maintains fertility, reduces crusting, and increases the water infiltration rate.

This soil is very well suited to woodland. Some areas remain in native hardwoods, particularly on the more narrow bottom land. Floodwater can damage young seedlings. Plant competition can be controlled by harvesting mature trees, cutting cull trees, thinning, and weeding. Restricting the use of equipment during wet periods prevents compaction of the surface layer.

This soil provides good habitat for either openland or woodland wildlife. If flooded, it provides a temporary feeding and resting site for migrating and resident waterfowl.

Stream channels are in many areas. These areas are generally enclosed by strongly sloping to very steep soils on wooded hillsides. This setting favors picnicking, hiking, and sightseeing. Flash flooding is a hazard if the soil is used as a site for overnight camping or similar activities.

This soil is generally unsuited as a site for buildings and waste disposal systems. Flooding is a hazard unless the site is adequately protected by levees or upstream structures.

Capability class I.

333—Wakeland silt loam. This nearly level, somewhat poorly drained soil is along streams and overflow channels and on alluvial fans on bottom land. It is subject to frequent flooding for brief periods from January through May. Individual areas are long or irregularly shaped and range from about 5 to 200 acres in size.

Typically, the surface layer is dark brown silt loam about 7 inches thick. The substratum to a depth of about 60 inches is grayish brown silt loam mottled with yellowish brown. In a few areas a thin, compact layer is in the lower part of the substratum. In some areas on bottom land along the Mississippi River, the lower part of the substratum has strata of clay loam or silty clay loam.

Included with this soil in mapping are small areas of the well drained Haymond soil on slight rises and areas of the poorly drained Birds soil in slight depressions. Also included, along some streams or overflow channels, are small areas of Elsah and Burnside soils, which are cherty or channery within a depth of 25 inches. Included soils make up about 10 to 15 percent of this unit.

Water and air move through this soil at a moderate rate, and surface runoff is slow. The substratum ranges from medium acid to neutral. The surface layer is friable or very friable and can be tilled easily. The seasonal high water table is 1 foot to 3 feet below the surface. Organic-matter content is low in the surface layer. Natural fertility is medium. Available water capacity is very high. If adequately drained, the soil can be readily penetrated by plant roots.

Most of the broader areas are cultivated, but some areas are woodland or pasture. This soil has good potential for cultivated crops, hay, pasture, and woodland and for woodland wildlife habitat. The potential for most recreation uses, building site development, and sanitary facilities is poor.

This soil is well suited to corn, soybeans, grain sorghum, grasses and legumes, and most vegetables. The flood hazard is the main concern. Streambank cutting and scouring occur in places. Adequate channels and levees reduce the flood hazard. Surface ditches or subsurface tile is needed in some areas to control the seasonal wetness. Diversions can intercept the runoff from higher lying areas. Returning crop residue to the soil or regularly adding other organic material maintains fertility, reduces crusting, and increases the water infiltration rate.

Grasses and legumes are well suited to this soil. Clipping and spraying control weeds and brush. Proper stocking rates, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is well suited to woodland. Many areas remain in native hardwoods (fig. 8). Competing vegetation can be controlled by harvesting mature trees, thinning, cutting cull trees, and weeding. Floodwater can damage seedlings. Species that can tolerate the seasonal wetness should be planted. Restricting the use of equipment during wet periods helps to prevent compaction of the surface layer.

This soil is suited to either openland or woodland wildlife habitat. If flooded, it furnishes a temporary feeding and resting site for migrating and resident waterfowl.

Stream channels are in many areas. These areas are generally enclosed by strongly sloping to very steep soils on wooded hillsides. This setting favors picnicking, hiking, and sightseeing. Flash flooding is a hazard if the soil is used as a site for overnight camping or similar activities.

Because of the flood hazard, this soil is generally unsuited as a site for buildings and waste disposal systems. Levees or upstream structures can provide protection from floodwater.

Capability subclass IIw.

334—Birds silt loam. This nearly level, poorly drained soil occurs mainly as low-lying areas on the more extensive bottom land. It is subject to flooding for long periods during the spring. Individual areas are long or round and range from about 10 to 300 acres in size.

Typically, the surface layer is light brownish gray silt loam about 11 inches thick. The substratum to a depth of about 60 inches is light gray and gray silt loam mottled with reddish yellow. In a few places a thin, compact layer is in the lower part of the substratum. In some areas on bottom land along the Mississippi River, the lower part of the substratum has strata of clay loam or silty clay loam.

Included with this soil in mapping are small areas of the somewhat poorly drained Wakeland soil on slight rises and the somewhat clayey Piopolis soil in slight depressions. Also included are a few areas where water ponds for extended periods. Included areas make up about 10 to 15 percent of this unit.

Water and air move through this soil at a moderately slow rate, and surface runoff is slow to ponded. The substratum ranges from medium acid to neutral. The surface layer is friable and can be tilled easily, but it tends to remain wet until late in spring. The seasonal high water table is within 1 foot of the surface. Organic-matter content is low in the surface layer. Natural fertility is medium. Available water capacity is high.

Most areas are cultivated or pastured. Some are wooded. This soil has good potential for cultivated crops if adequate drainage is provided. It also has good potential for hay or pasture. It has fair to good potential for woodland and for most kinds of wildlife habitat. The potential for most recreation uses, for building site development, and for sanitary facilities is poor.

This soil is well suited to corn, soybeans, and grain sorghum. Flooding and seasonal wetness are the main problems. Adequate stream channels and levees can reduce the flood hazard. Shallow surface ditches are needed in many areas to remove standing water and control the seasonal wetness. Diversions are needed in some areas to intercept the runoff from higher lying areas. Returning crop residue to the soil maintains fertility, improves tilth, and reduces crusting.

This soil is suited to grasses and legumes for hay or pasture. Species that are tolerant of wetness should be selected. Clipping and spraying control weeds and brush. Proper stocking rates, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

Some areas remain in native hardwoods. This soil is suited to woodland. Suitable species grow well if plant competition is controlled by harvesting mature trees, thinning, cutting cull trees, and weeding. The use of equipment is limited by wetness, and flooding delays harvesting in some years. Restricting the use of equipment when the soil is wet helps to prevent compaction of the surface layer.

This soil is well suited as habitat for openland, woodland, and wetland wildlife. Shallow water areas for waterfowl can be developed easily.

This soil is generally unsuited as a site for buildings and waste disposal systems because of the seasonal wetness and the flood hazard. Levees can provide protection from floodwater.

Capability subclass IIIw.

420—Piopolis silty clay loam. This nearly level, poorly drained soil is on flood plains along the major streams. It is subject to frequent flooding for long periods in spring. Individual areas are long or round and range from about 10 to more than 40 acres in size.

Typically, the surface layer is about 7 inches of mixed grayish brown and dark brown silty clay loam. The subsoil is silty clay loam about 38 inches thick. It is light brownish gray in the upper part and light gray and light olive gray in the lower part. The substratum to a depth of about 60 inches is light olive gray silty clay loam. In some areas the subsoil has strata of loamy material and silty clay. In a few areas the substratum has loamy rather than silty layers below a depth of 3 feet.

Included with this soil in mapping are areas that have received silty overwash. Also included are slightly depressional areas of the more clayey Jacob and Karnak soils. Included areas make up about 10 to 15 percent of this unit.

Water and air move through this soil at a slow rate, and surface runoff is ponded. The seasonal high water table is less than 1 foot from the surface. The subsoil is strongly acid or very strongly acid. The surface layer is firm and somewhat clayey. It dries slowly in spring and clods if worked when wet. It is low in content of organic matter. Natural fertility is low. Available water capacity is high.

Most areas are cultivated or support native trees. This soil has fair potential for cultivated crops, hay, and pasture. It has good potential for woodland and for wetland wildlife habitat. The potential for recreation uses, building site development, and sanitary facilities is poor.

This soil is suited to corn, soybeans, and grain sorghum if it is protected from overflow and adequately drained. Shallow surface ditches are needed in many areas to remove standing water and control the seasonal wetness. Additions of crop residue or other organic material can improve the tilth of the surface layer. Crops are occasionally damaged by overflow during the growing season.

This soil is well suited to woodland. Growth is improved if competing vegetation is removed by harvesting mature trees, thinning, cutting cull trees, and weeding. The use of equipment is limited by wetness and overflow, and hand planting is often necessary. Seedling mortality can be reduced by planting suited species. Restricting the use of equipment during wet periods helps to prevent compaction of the surface layer.

Some areas provide habitat for wetland wildlife. A few shallow water areas are evident, and many others could be developed. This soil is suited to woodland wildlife habitat if it is left in native vegetation.

This soil is generally unsuited as a site for buildings and waste disposal systems because of the seasonal wetness, the flood hazard, and frost action.

Capability subclass IIIw.

422—Cape silty clay loam. This nearly level, poorly drained soil is mainly on low-lying benches on bottom land along the Mississippi River. In a few areas it is on the bottom land along Cypress Creek. In nearly all areas it is on the protected side of the levee. The unprotected areas are subject to frequent flooding for long periods in spring. Individual areas are irregularly shaped or long and range from about 5 to 50 acres in size.

Typically, the surface layer is dark grayish brown silty clay loam about 12 inches thick. The subsoil is about 35 inches thick. It is mainly gray or grayish brown, mottled silty clay or silty clay loam. The substratum to a depth of about 60 inches is grayish brown silty clay loam. In places the surface layer is darker. In some areas the substratum has strata of loamy material.

Included with this soil in mapping are a few areas where slopes are short and steep. Also included are the less acid Karnak soils in depressional areas and the less clayey Piopolis soil on slight rises or near overflow channels. Included areas make up about 10 to 15 percent of this unit.

Water and air move through this soil at a very slow or slow rate, and surface runoff is slow. The subsoil ranges from extremely acid to strongly acid. The water table is perched within 1 foot of the surface in spring. The surface layer is firm and is somewhat difficult to till. It dries slowly and clods if worked when wet. Organic-matter content and natural fertility are low. Available water capacity is moderate.

Most areas are used for cultivated crops. This soil has fair potential for cultivated crops, hay, and pasture and good potential for trees. It has poor potential for most recreation uses and fair potential for most kinds of wildlife habitat. The potential for building site development and septic tank absorption fields is poor.

This soil is suited to corn, soybeans, grain sorghum, small grain, and grasses and legumes. Seasonal wetness limits the choice of plants in some years. Shallow surface ditches can reduce the wetness. Tilth and workability can be improved by conservation tillage and by incorporation of crop residue into the surface layer.

Only a small acreage is used for pasture or hay. Wetness limits the choice of plants. Restricted use during wet periods keeps the pasture and the soil in good condition.

Many areas support native vegetation and provide food and cover for woodland or wetland wildlife. Some shallow water areas are evident, and many others could be developed.

This soil has serious limitations as a site for buildings, local roads and streets, and waste disposal systems. Providing adequate drainage is difficult because water moves very slowly through the soil. Flooding is a hazard in the unprotected areas. Sewage lagoons can be installed only if properly designed and laid out and if adequately protected from overflow.

Capability subclass IIIw.

426—Karnak silty clay. This nearly level, poorly drained or very poorly drained soil is on broad flats and in narrow depressions on flood plains. It is subject to rare flooding. Individual areas are mainly long or elliptical and range from about 10 to 400 acres in size.

Typically, the surface layer is very dark gray silty clay about 6 inches thick. The subsoil is dark gray and gray silty clay or clay about 52 inches thick. The substratum to a depth of about 75 inches is gray silty clay. In some areas the subsoil and substratum have strata of silty clay loam.

Included with this soil in mapping are areas near overflow channels that have received silty or loamy overwash and some areas where the subsoil has slightly acid to mildly alkaline layers. Also included are small areas of Cairo soils on slight rises. These Cairo soils are loamy within a depth of 40 inches. Included areas make up about 10 to 15 percent of this unit.

Water and air move through this soil at a very slow rate, and surface runoff is slow to ponded. The seasonal high water table is within 3 feet of the surface. The subsoil is medium acid or strongly acid. This very clayey soil shrinks during dry periods and swells during wet periods. The surface layer is very firm and difficult to till, and it dries out slowly. It clods if worked when wet. It is low in content of organic matter. Natural fertility is low or medium. Available water capacity is moderate. The seasonal wetness and the clayey subsoil prevent deep penetration of roots.

Most areas are cultivated or remain in native hardwoods. This soil has poor to fair potential for cultivated crops, hay, or pasture. It has fair potential for woodland wildlife habitat and good potential for wetland wildlife habitat. The potential for recreation uses, for building site development, and for sanitary facilities is poor.

This soil is suited to soybeans and grain sorghum if it is adequately drained and protected from overflow. It is somewhat less suited to corn because of the moderate available water capacity and the restricted penetration of roots. Wheat is often damaged by water in winter. Shallow ditches and land leveling can provide drainage in most areas. Surface tilth can be improved by a conservation tillage system, in which most of the crop residue is left on the surface.

This soil is well suited to woodland. Seedling mortality and plant competition are the main concerns of management. Flooding and deposition can damage seedlings. Plant competition can be controlled by harvesting mature trees, thinning, cutting cull trees, and weeding. Hand planting of species that can withstand wetness generally obtains the best results.

Many areas support native vegetation and provide food and cover for woodland or wetland wildlife. Some shallow water areas are evident, and many others could be developed.

This soil has serious limitations as a site for buildings, local roads and streets, and waste disposal systems. Providing adequate drainage is difficult because water moves very slowly through the soil.

Capability subclass IIIw.

427—Burnside loam. This nearly level and gently sloping, moderately well drained soil is on narrow bottom land. It is subject to occasional flooding for brief periods in spring. Individual areas are long and narrow and range from about 5 to 30 acres in size.

Typically, the surface layer is dark brown loam about 14 inches thick. The subsoil is about 8 inches of dark yellowish brown channery loam. The substratum to a depth of about 60 inches is dark yellowish brown flaggy or very flaggy loam. In places the surface layer is silt loam. In some areas the subsoil has slightly acid layers.

Included with this soil in mapping are areas where a loamy or silty surface layer is more than 24 inches thick, areas where bedrock is within a depth of 40 inches, and areas, along some overflow channels, where the surface layer is stony. Also included are some depressional areas of the somewhat poorly drained Wakeland soil. Included areas make up about 10 to 15 percent of this unit.

Water and air move through this soil at a moderate rate, and surface runoff is slow. The soil is strongly acid or very strongly acid between depths of 10 and 40 inches. The seasonal high water table is at a depth of 3 to 5 feet in winter and spring. The surface layer is very friable and dries quickly after rains. It is low in content of organic matter. Natural fertility is medium. Available water capacity is moderate. The penetration of roots is restricted by the coarse fragments.

Most areas are woodland or pasture. This soil has good potential for hay, pasture, and woodland and for openland or woodland wildlife habitat. It has fair potential for cultivated crops and for most recreation uses. The potential for building site development and sanitary facilities is poor.

This soil is suited to soybeans and grain sorghum, but fields are long and narrow and access generally is limited. The soil is well suited to most vegetable crops. Conservation tillage and crop residue management reduce soil loss. Crops are damaged by floodwater during the growing season in some years.

This soil is suited to pasture and hay. Clipping and spraying are needed to control competing vegetation. Proper stocking rates and restricted use during wet periods keep the pasture and the soil in a good condition.

This soil is very well suited to woodland. Seedlings can survive and grow well if competing vegetation is controlled or removed by harvesting mature trees, thinning, cutting cull trees, and weeding. Restricting the use of equipment when the soil is wet helps to prevent compaction of the surface layer.

Stream channels are in most areas of this soil. These areas are generally enclosed by strongly sloping or moderately steep soils on wooded hillsides. This setting favors picnicking, hiking, and sightseeing. The possibility of flash floods prohibits the use of this soil as a site for overnight camping or similar activities.

This soil is generally unsuited as a site for buildings, local roads and streets, and waste disposal systems because of the flood hazard. Levees or upstream structures can provide protection from floodwater. Diversions are needed in some areas to intercept runoff from higher lying areas. Excessive seepage from lagoon reservoir areas or from septic tank filter fields is likely. As a result, the ground water supply can be contaminated. The soil is fair roadfill material.

Capability subclass IIs.

456—Ware loam. This nearly level and gently sloping, moderately well drained soil is on ridges and natural levees on the flood plain of the Mississippi River. It is on the protected side of the levee and is subject to rare

flooding. Individual areas are mainly long and range from about 5 to 100 acres in size.

Typically, the surface layer is very dark grayish brown loam about 9 inches thick. The subsoil is about 12 inches thick. It is dark grayish brown loam over brown fine sandy loam. The substratum to a depth of about 60 inches is mainly brown, stratified loamy very fine sand, very fine sandy loam, loam, and fine sand. In places the surface layer is dark grayish brown.

Included with this soil in mapping are small sandy areas and a few areas where slopes are short and steep. Also included are areas of the more clayey Medway soils in depressions. Included areas make up about 10 to 15 percent of this unit.

Water and air move through the upper part of this soil at a moderate rate and through the more sandy substratum at a moderately rapid rate. The subsoil ranges from medium acid to moderately alkaline. The seasonal high water table is at a depth of 4 to 6 feet in spring. Surface runoff is slow. The surface layer is very friable and can be tilled easily. It dries quickly after rains and warms up early in spring. It is moderate in content of organic matter. Natural fertility is medium. Available water capacity is moderate to low.

Most areas are cultivated. This soil has good potential for cultivated crops, hay, pasture, woodland, and most vegetables. It has fair to good potential for most recreation uses and good potential for woodland or openland wildlife habitat. The potential is poor for building site development and fair for septic tank absorption fields.

This soil is well suited to corn, soybeans, grain sorghum, and vegetables. The somewhat limited available water capacity is the main concern of management. Conservation tillage, return of crop residue to the soil, and cover crops can control soil blowing and water erosion and conserve soil moisture. This soil is well suited to irrigation, and a supply of water is generally available.

This soil is suitable as pastureland and hayland. Competing vegetation can be controlled by clipping or spraying. Proper stocking rates and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is one of the better building sites on the flood plain along the Mississippi River, but it is generally unsuited as a building site because of the possibility of a break in the levee during high flood stages. Also, during some periods when the water level is high, areas of this soil are inaccessible because of ponded water on the surrounding low-lying soils. The soil is a possible source of roadfill material. Excessive seepage from lagoon reservoir areas or from septic tank filter fields is likely. As a result, the ground water supply can be contaminated.

Capability subclass IIs.

475—Elsah silt loam. This nearly level and gently sloping, well drained or somewhat excessively drained soil is on narrow bottom land and adjacent to stream channels on the more extensive bottom land. It is subject to frequent flooding for brief periods from December through May. Individual areas are mainly long and narrow and range from about 10 to 75 acres in size.

Typically, the surface layer is dark brown silt loam about 15 inches thick. The substratum to a depth of about 60 inches is mainly strong brown, light yellowish brown, and brown very cherty and very cobbly loam. In places the surface layer is cherty. In some areas the substratum has strongly acid layers.

Included with this soil in mapping are areas where the silty surface layer is more than 25 inches thick and areas where bedrock is within 40 inches of the surface. Also included is the somewhat poorly drained Wakeland soil in some depressional areas. Included areas make up about 10 to 15 percent of this unit.

Water and air move through the upper part of this soil at a moderate rate and through the cherty material at a moderately rapid rate. The substratum ranges from medium acid to neutral. The surface layer is very friable and can be tilled easily. It dries out quickly after rains and warms up early in spring. It is low in content of organic matter. Natural fertility is medium. Available water capacity is moderate. The penetration of roots is restricted by the coarse fragments.

Most areas are wooded. Some are farmed. This soil has fair potential for cultivated crops and most recreation uses. It has fair to good potential for hay, pasture, and woodland and for openland or woodland wildlife habitat. The potential for building site development and sanitary facilities is poor.

This soil is well suited to corn, grain sorghum, and most vegetables. Many fields are long and narrow, however, and access generally is limited. Overflow and possible stream cutting and scouring are the main concerns of management. Returning crop residue to the soil helps to maintain fertility, improves tilth, and reduces crusting. Crops can be damaged during the growing season in some years. Diversions are needed in some areas to intercept runoff from higher lying areas.

This soil is suited to pasture and hay. Clipping and spraying are needed to control competing vegetation. Proper stocking rates and restricted use during wet periods keep the pasture and the soil in good condition.

Grain and seed crops and grasses and legumes can be grown on this soil to improve openland wildlife habitat. Trees and shrubs are easily established, and stands of native trees provide good woodland wildlife habitat.

This soil is well suited to woodland. Seedlings can survive and grow well if competing vegetation is controlled by thinning, weeding, and cutting cull trees. Restricting the use of equipment during wet periods helps to prevent compaction of the surface layer.

Stream channels cut through areas of this soil. Most areas are enclosed by moderately steep to very steep soils on wooded hillsides. This setting favors picnicking, hiking, and sightseeing. Overnight camping or similar ac-

tivities should be avoided because flash flooding is a hazard.

This soil is generally unsuited as a site for buildings, local roads and streets, and waste disposal systems because of the flood hazard. Levees or upstream structures can provide protection from floodwater. The soil is fair roadfill material. Excessive seepage from reservoir areas of lagoons or from septic tank filter fields is likely. As a result, the ground water supply can be contaminated.

Capability subclass IIs.

589—Bowdre silty clay. This nearly level and gently sloping, somewhat poorly drained soil is on low ridges in sloughs or overflow channels on bottom land along the Mississippi River. It is on the protected side of the levee and is subject to rare flooding. Individual areas are long and range from about 5 to 50 acres in size.

Typically, the surface layer is very dark grayish brown silty clay about 11 inches thick. The subsoil is dark brown silty clay loam or loam about 12 inches thick. The substratum to a depth of about 60 inches is mainly dark brown and brown very fine sandy loam that has strata of loam and silt loam. In some areas the substratum has strata of loamy fine sand or silty clay loam. In places the surface layer is silty clay loam.

Included with this soil in mapping are Cairo and Darwin soils in lower lying or depressional areas. These poorly drained soils are deeper to loamy material than the Bowdre soil. Also included are areas along overflow channels where loamy overwash is evident. Included areas make up about 10 to 15 percent of this unit.

Water and air move through the clayey upper part of this soil at a slow rate and through the loamy lower part at a moderate rate. Surface runoff is slow. The water table is perched at a depth of 1 1/2 to 2 feet during the period January through April. The subsoil and substratum range from slightly acid to moderately alkaline. The surface layer is firm and clayey. It is difficult to till and clods if worked when wet. It cracks when it dries. It is moderate in content of organic matter. Natural fertility is medium. Available water capacity is high.

Most areas are cultivated. This soil has fair potential for cultivated crops, hay, pasture, and openland or woodland wildlife habitat. It has good potential for woodland. The potential for most recreation uses, for building site development, and for sanitary facilities is poor.

This soil is suited to corn, soybeans, grain sorghum, and wheat. In some areas water damages wheat. The tilth of the surface layer is the main concern of management. Tilling the clayey surface layer and preparing a seedbed are difficult. Conservation tillage and additions of crop residue or other organic material to the surface layer improve tilth and reduce surface crusting and soil loss.

This soil is suitable as pastureland and hayland. Overgrazing or grazing when the soil is wet reduces productivity and causes surface compaction, excessive runoff, and poor tilth.

This soil is generally not suited as a site for buildings, local roads and streets, and waste disposal systems. A break in the levee during high flood stages can result in flood damage.

Capability subclass IIw.

590—Cairo silty clay. This is a nearly level and gently sloping, poorly drained soil on broad flats and in slight depressions in the flood plain of the Mississippi River. It is on the protected side of the levee. It is subject to common flooding for brief periods in winter and spring because of runoff from adjacent soils. Individual areas are mainly long and range from about 5 to 75 acres in size.

Typically, the surface layer is about 10 inches of black silty clay. The subsoil is about 29 inches thick. It is very dark grayish brown and dark gray silty clay in the upper part and gray clay loam in the lower part. The substratum to a depth of about 73 inches is olive gray loamy very fine sand and light brownish gray fine sand. In some areas the surface layer is silty clay loam. In a few areas it is dark grayish brown.

Included with this soil in mapping are areas of Bowdre, Darwin, and Gorham soils. Bowdre and Gorham soils are mainly on slight rises. Bowdre soils are loamy within a depth of 20 inches, and Gorham soils are less clayey than the Cairo soil. Darwin soils are in slightly depressional areas. They are generally clayey to a depth of 50 inches or more. Also included are areas where the subsoil is medium acid or strongly acid. Included soils make up about 10 to 15 percent of this unit.

Water and air move through the clayey upper part of this soil at a very slow rate. The subsoil ranges from slightly acid to mildly alkaline. The surface layer is firm and difficult to till. It clods if worked when wet and cracks upon drying. It is moderate in content of organic matter. Natural fertility is medium or high. Available water capacity is low or moderate. The seasonal high water table is generally within 2 feet of the surface.

Most areas are cultivated. This soil has fair potential for cultivated crops, hay, pasture, woodland, and wildlife habitat. The potential for recreation uses, building site development, and sanitary facilities is poor.

This soil is suited to corn, soybeans, grain sorghum, and wheat. Seasonal wetness and poor tilth are the main concerns of management. In some areas water damages wheat. Land leveling and surface ditches help to remove excess water. Working the clayey surface layer is difficult, and seedbeds are often cloddy. Conservation tillage and crop residue management maintain fertility, improve tilth, and reduce soil loss.

This soil is suitable as pastureland and hayland if it is drained. Species tolerant of wetness should be selected. Proper stocking rates, timely deferment of grazing, and

restricted use during wet periods improve the condition of the pasture and the soil.

Because of the possibility of flooding after a break in the levee, this soil is generally unsuited as a site for buildings, local roads and streets, and waste disposal systems. Providing adequate drainage is difficult because water moves very slowly through the soil. Drainage is needed to control seasonal wetness and to carry runoff away from footings or slabs during and after construction. If protection from overflow is adequate, sewage lagoons that are properly designed and laid out can be installed. If the basin extends into the loamy substratum, however, seepage is likely to be excessive and the ground water supply contaminated unless the basin floor is adequately sealed.

Capability subclass IIIw.

682—Medway silty clay loam. This nearly level and gently sloping, moderately well drained soil is on narrow to broad, low ridges and natural levees along sloughs or overflow channels on the flood plain of the Mississippi River. It is on the protected side of the levee. It is subject to occasional flooding for very brief periods in winter and spring. Individual areas are mainly long and range from about 5 to 150 acres in size.

Typically, the surface layer is very dark grayish brown silty clay loam about 9 inches thick. The subsoil is about 27 inches thick. The upper part is very dark grayish brown silty clay loam and dark grayish brown clay loam, and the lower part is dark brown loam and very fine sandy loam. The substratum to a depth of about 60 inches is brown and pale brown loamy very fine sand and loamy fine sand. In places the surface layer and subsoil are loam or silt loam.

Included with this soil in mapping are areas along overflow channels where loamy overwash is evident and a few areas where slopes are short and steep. Also included are areas of Ware, Bowdre, and Gorham soils. Ware soils are on slight rises. They contain more sand than this Medway soil. Bowdre and Gorham soils are in a position on the landscape similar to that of the Medway soil or are low lying. Bowdre soils contain more clay in the upper part than the Medway soil, and Gorham soils are poorly drained. Included areas make up about 10 to 15 percent of this unit.

Water and air move through this soil at a moderate rate, and surface runoff is slow. The subsoil ranges from slightly acid to mildly alkaline. The seasonal high water table is at a depth of 1 1/2 to 3 feet in winter and spring. The surface layer is firm but generally can be tilled easily. It is moderate or high in content of organic matter. Natural fertility is high. Available water capacity also is high. Plant roots readily penetrate the soil.

Most areas are cultivated. This soil has good potential for cultivated crops, hay, pasture, and woodland and for openland wildlife habitat. It has poor potential for building site development and sanitary facilities.

This soil is well suited to corn, soybeans, grain sorghum, wheat, and most vegetables. Erosion is a hazard in the gently sloping areas. Conservation tillage, restricted use of equipment when the soil is wet, and the return of crop residue or other organic material to the surface layer keep the soil in good condition and reduce soil loss.

This soil is one of the better building sites on the flood plain of the Mississippi River, but it is generally unsuited as a building site. Flooding is a hazard because of the possibility of a break in the levee during high flood stages. During some periods when the water level is high, the site is inaccessible because of ponded water on surrounding low-lying soils. Runoff and other excess water should be removed during and after construction. Because of excessive seepage, the effluent from septic tank filter fields or basins of sewage lagoons can contaminate the ground water supply.

Capability class I.

787—Banlic silt loam. This nearly level, somewhat poorly drained soil is mainly on slight rises on flood plains. It is subject to rare flooding. Individual areas are mainly irregular in shape and range from about 5 to 25 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsurface layer is dark grayish brown silt loam about 5 inches thick. The subsoil is about 35 inches thick. The upper 9 inches is brown, friable silt loam. The lower 26 inches is dominantly light brownish gray, firm and brittle silt or silt loam that is mottled with yellowish brown. It has white or light gray uncoated silt grains. The substratum to a depth of about 60 inches is light brownish gray silt loam. In places the subsoil is thinner and less dense.

Included with this soil in mapping are areas of Wakeland and Haymond soils, which do not have a dense layer in the subsoil. These soils generally are adjacent to old stream channels where more recent material has been deposited. They make up about 10 to 15 percent of this unit.

Water and air move through this soil at a slow rate, and surface runoff is slow. The subsoil ranges from medium acid to very strongly acid. The surface layer is friable but tends to puddle or crust after hard rains if the surface is bare. The penetration of roots and the downward movement of water are restricted by the dense subsoil. Organic-matter content is low in the surface layer. Natural fertility is medium. Available water capacity is moderate. The seasonal high water table generally is perched above the subsoil.

Most areas are cultivated. This soil has fair potential for cultivated crops, hay, pasture, woodland, and most recreation uses. It has fair to good potential for wildlife habitat. The potential for building site development and septic tank absorption fields is poor.

This soil is suited to corn, soybeans, grain sorghum, and wheat. The main concerns of management are seasonal wetness and tilth. Excess surface water and runoff can be removed by surface ditches. Diversions are needed in places to intercept runoff from higher lying areas. Conservation tillage and the return of crop residue or other organic material to the surface layer improve tilth and conserve soil moisture.

This soil is generally unsuited as a site for buildings and waste disposal systems because of the flood hazard. Levees or upstream structures can provide protection from floodwater.

Capability subclass IIw.

801B—Orthents, silty, 1 to 5 percent slopes. These nearly level and gently sloping, somewhat poorly drained or moderately well drained soils are in cut and fill areas on uplands, mainly in borrow pits and fill areas. The accompanying side slopes are short and steep. Individual areas are mainly rectangular and range from about 10 to 50 acres in size.

In a typical profile, the surface layer is yellowish brown silt loam. The substratum to a depth of about 60 inches is multicolored silt loam. In many areas the soil has strata of loam and silty clay loam. In some areas the content of coarse fragments is 5 to 15 percent.

Included with these soils in mapping are stony areas and areas where the soil is clayey or sandy. Also included are areas where cinders, bricks, and other debris are evident. Included areas make up about 10 to 15 percent of this unit.

Water and air move through these soils at a slow or moderately slow rate, and surface runoff is slow or medium. Reaction is mainly medium acid or strongly acid but ranges from extremely acid to mildly alkaline. Organic-matter content is low in the surface layer. Natural fertility is low. Available water capacity is moderate to high.

Most areas have been construction sites or sites associated with construction. These soils have fair potential for most uses. The use of these soils is affected by the use of adjacent soils.

Most areas are suited to corn, soybeans, grain sorghum, wheat, and grasses or legumes. Poor tilth, low fertility, and wetness in the more nearly level areas or erosion in the more sloping areas are the main management problems. Shallow surface ditches or diversion terraces are needed in some areas to remove excess water. Conservation tillage, contour farming, cover crops, and a conservation cropping system can help to prevent excessive erosion and improve tilth. Returning crop residue to the surface layer or adding other organic material also improves tilth. Grassed waterways are needed in places to safely convey runoff downslope. Lime is needed in the more acid areas. If a high level of fertility is maintained, plant roots can penetrate deeper and grow more extensively. As a result, more water is available later in the growing season, particularly during dry periods.

These soils generally are suited as sites for buildings, local roads and streets, and waste disposal systems that are properly designed and laid out. The seasonal wetness, the erosion hazard, and the possibility of frost action are the main concerns. Other concerns are the steepness of some side slopes and the settling that is likely to occur in fill areas unless the fill material has been properly compacted. Particular attention is needed to control wetness and remove onsite runoff. Septic tank filter fields commonly do not function adequately because of the slow or moderately slow movement of water through the soil. Sewage lagoons can be installed only if they are properly designed and laid out.

Not assigned to a capability class or subclass.

802D—Orthents, loamy, 2 to 20 percent slopes. These gently sloping to strongly sloping, well drained soils are on side slopes, aprons, and crests of the levees along the Mississippi River and Cedar Creek. Individual areas are long and range from about 10 to 20 acres in size.

In a typical profile, the surface layer is about 6 inches of dark brown loam. The substratum to a depth of about 60 inches is multicolored loam or very fine sandy loam. It has bands of silty clay loam in the lower part. In most areas the soils are stratified, dominantly with loamy material but also with loamy fine sand and fine sand. On the levee along Clear Creek, they are less stratified and are dominantly silt loam.

Included with these soils in mapping are wet borrow pits and areas of clayey soils. These included areas make up about 10 to 15 percent of the levee part of this unit.

Water and air move through these soils at a moderate rate. Surface runoff is medium to rapid. Reaction ranges from slightly acid to moderately alkaline. Organic-matter content is low in the surface layer. Natural fertility is medium. Available water capacity is moderate.

Most areas are covered with grass. The poorly drained included depressional areas are either wooded or intermittently covered with water. In most areas these soils have poor to fair potential for most uses. The use of these soils is affected by the use of adjacent soils.

The more sloping areas on the levee are suited to grasses and legumes. This plant cover protects the soil against erosion. Proper stocking rates, pasture rotation, and restricted use during wet periods keep the pasture and the soil in good condition.

The included poorly drained borrow pits are suited to woodland or wetland wildlife habitat. In most of the slightly higher areas, mainly along the edges of the borrow pits, trees are becoming established naturally. Overflow water is likely to damage seedlings. Many areas provide habitat for wetland wildlife. The extreme wetness limits the choice of plants that can be grown as

food for wildlife. Some shallow water areas are evident. Others could be developed, but controlling the depth of the water is difficult because of the flood hazard.

Not assigned to capability class or subclass.

852E—Alford-Wellston silt loams, 15 to 30 percent slopes. This map unit consists of strongly sloping and moderately steep, well drained soils on long hillsides adjacent to drainageways or bottom land. Individual areas are mainly long or irregularly shaped and range from about 20 to 200 acres in size. They are about 55 to 75 percent Alford soil and 25 to 45 percent Wellston soil. The Alford soil is on the upper and mid parts of side slopes and on convex spur ridges, and the Wellston soil is on the lower part of side slopes and along lateral drainageways that dissect the hillsides. These two soils occupy the same hillsides on a mostly wooded landscape and have not been separated in mapping.

Typically, the Alford soil has a dark brown and yellowish brown silt loam surface layer about 9 inches thick. The subsoil is mainly strong brown and dark brown silt loam about 40 inches thick. The substratum to a depth of about 66 inches is dark yellowish brown silt loam. In places a thin, compact and brittle layer is in the lower part of the subsoil. It has grayish streaks and mottles.

Typically, the Wellston soil has a very dark grayish brown and yellowish brown silt loam surface layer about 13 inches thick. The upper 26 inches of the subsoil is mainly yellowish brown silt loam. The lower part of the subsoil to a depth of about 62 inches is pale brown channery loam and dark yellowish brown and yellowish brown channery silty clay loam.

Included with these soils in mapping are areas of the moderately well drained Zanesville soils on the convex spur ridges and areas of a stony soil along drainageways and directly above and below bedrock escarpments. Also included are some areas where the subsoil is clayey and small areas of Burnside soils on bottom land. Included areas make up about 10 to 15 percent of this unit.

Water and air move through these soils at a moderate rate, and surface runoff is rapid. The subsoil ranges from extremely acid to medium acid. Organic-matter content is low in the surface layer. Natural fertility is medium. Available water capacity is high. Plant roots generally can readily penetrate these soils but are restricted in the Wellston soil by the coarse fragments in the lower part of the subsoil.

Most areas are woodland. These soils have poor potential for cultivated crops, fair potential for hay or pasture, and good potential for woodland and as habitat for woodland wildlife. The potential for recreation uses, building site development, and sanitary facilities is poor.

These soils are suited to pasture. Competing vegetation can be controlled by spraying or clipping. Pasture rotation, proper stocking rates, and restricted grazing during wet periods help to maintain the plant cover and prevent excessive erosion. The less sloping areas are suitable as hayland, but the steeper slopes limit the use of equipment.

These soils are suited to woodland. The competing vegetation, the erosion hazard, and the equipment limitation are the main problems. The competing vegetation can be controlled by harvesting mature trees, thinning, weeding, and cutting cull trees. The slope and the bedrock escarpments in the areas of Wellston soil hinder planting and harvesting. The soils are easily eroded if the plant cover is removed during logging operations. Diverting surface water from haul roads and skid trails helps to control erosion.

Many rolling to hilly areas are wooded. Carefully planned trails or paths can be constructed for hiking and sightseeing. Control of erosion is needed.

These soils are generally unsuited as sites for buildings, local roads and streets, and waste disposal systems. Extensive cutting and filling and extensive shaping generally are needed. Coarse fragments and bedrock interfere in some areas where cutting and shaping are needed. The hazard of erosion is severe. Special design, layout, and construction methods are needed. The cost may be prohibitive.

Capability subclass VIe.

864—Pits, quarry, limestone. This miscellaneous area consists mainly of nearly level and gently sloping basins and the accompanying nearly vertical sides of quarries. Individual areas are mainly rectangular and range from about 10 to 80 acres in size.

The basins and sidewalls are mainly exposed limestone bedrock. Strips of Alford soil are generally along the top of the sidewalls, and a talus slope is along the basin in places. Included in mapping are roads used in hauling the quarried material, stockpiles of crushed limestone, and some areas covered with machinery and debris. Included areas make up about 10 to 15 percent of this unit.

Runoff is medium in most areas but is ponded in depressional areas. Except for the bands of Alford soil along the top of the sidewalls, the areas have sparse plant cover or no plant cover.

This map unit has poor potential for most uses. Some areas are suitable for paths and trails. Some depressional areas are suitable as pond reservoir areas. Falling rock is a hazard.

Not assigned to a capability class or subclass.

930F—Alford-Goss complex, 20 to 35 percent slopes. This map unit consists of moderately steep and steep, well drained soils on dissected hillsides and toe slopes in the uplands. Individual areas are mainly irregular in shape and range from about 20 to 300 acres in size. They are about 50 to 75 percent Alford soil and 25 to 50 percent Goss soil. The Alford soil is on the upper part of the slopes on narrow ridgetops and on some foot

slopes. The Goss soil is on the lower part of the slopes. These two soils occupy the same hillsides on a dissected, wooded landscape and have not been separated in mapping.

Typically, the Alford soil has a dark brown silt loam surface layer about 7 inches thick. The subsoil is mainly strong brown silt loam about 41 inches thick. The substratum to a depth of about 72 inches is strong brown and yellowish brown silt loam. The subsoil is silty clay loam in places. Chert fragments are in the lower part of the subsoil in some areas.

Typically, the Goss soil has a grayish brown and light yellowish brown silt loam surface layer about 6 inches thick. The subsoil is mainly very cherty silty clay loam about 48 inches thick. The substratum to a depth of about 60 inches is fractured chert bedrock. In places the surface layer is cherty silt loam. In many places the subsoil is reddish brown or yellowish red cherty silty clay loam.

Included with these soils in mapping are some areas of less sloping soils on the upper slopes and on narrow ridgetops, steeper areas of soils in some coves, and many areas, on the lower slopes, of a cherty or very cherty loam that contains less clay in the subsoil. Also included are some areas of the Elsah soil on narrow bottom land. Included soils make up about 10 to 15 percent of this unit.

Water and air move through the Alford soil at a moderate rate. They move through the upper part of the Goss soil at a moderately rapid rate and through the lower part at a moderate rate. Surface runoff is rapid. The subsoil of both soils is mainly medium acid to very strongly acid, but the lower part of the subsoil in the Goss soil ranges to neutral. Organic-matter content is low in both soils. Natural fertility is medium in the Alford soil and low in the Goss soil. Available water capacity is high in the Alford soil and low in the Goss soil. The penetration of roots is restricted by the chert fragments in the Goss soil.

Most areas remain in native woodland. These soils have poor potential for most uses but have fair potential for woodland and for woodland wildlife habitat.

The Alford soil is very well suited and the Goss soil poorly suited to woodland. The equipment limitation and a severe erosion hazard are the chief problems in managing the soils as woodland. Trees adequately protect the soils against erosion, but areas exposed during logging can erode rapidly. Logging trails and roads should be established on the contour if possible, and bare areas should be seeded after logging. Diverting surface water from haul roads and skid trails helps to control erosion. The steep and moderately steep slopes hinder the equipment used in cutting and removing logs, but special equipment and safety precautions can overcome this limitation.

In most areas the soils are hilly and very hilly and wooded. Carefully planned trails or paths can be constructed for hiking and sightseeing. Control of erosion is needed.

Because they are steep and moderately steep, these soils generally are unsuited as sites for buildings, local roads and streets, and waste disposal systems. Other limitations are the coarse fragments and bedrock, possible soil creep, and shrinking and swelling of the more clayey material. The soils generally are well suited as roadfill or as material supporting footings. The erosion hazard is severe in exposed areas, and revegetating is difficult. Special design, layout, and construction methods are needed. The cost may be prohibitive.

Capability subclass VIs.

930G—Goss-Alford complex, 30 to 70 percent slopes. This map unit consists of steep and very steep, well drained soils on ridgetops and dissected hillsides in the uplands. Individual areas are irregularly shaped or round and range from about 20 to more than 1,000 acres in size. They are about 50 to 80 percent Goss soil and 20 to 45 percent Alford soil. The Goss soil is on the mid and lower part of slopes and in coves, and the Alford soil is on the upper part of the slopes and on narrow ridgetops. The proportion of the Goss soil is generally higher on south-facing slopes than on north-facing slopes. The two soils are closely associated on ridgetops and hillsides on a wooded landscape and have not been separated in mapping.

Typically, the Goss soil has a very dark grayish brown very cherty silt loam surface layer about 3 inches thick. The subsurface layer is brown very cherty silt loam about 3 inches thick. The subsoil to a depth of about 60 inches is strong brown very cherty or cherty silt loam, silty clay loam, and silty clay.

Typically, the Alford soil has a dark brown and yellowish brown silt loam surface layer about 6 inches thick. The subsoil is yellowish brown silt loam about 61 inches thick. The substratum to a depth of about 92 inches is yellowish brown silt loam. Chert fragments are in the lower part of the subsoil and in the substratum in places.

Included with these soils in mapping are less sloping areas near ridgetops and on some foot slopes; some areas, in the southern part of the county, where cherty limestone bedrock and shale bedrock are near the surface; and, on many of the lower slopes and near the southern part of the county, a soil that has a cherty or very cherty loam subsoil. Also included is a sandy area, of apparently wind-blown material, along Clear Creek near State Route 146. Included areas make up about 10 to 15 percent of this unit.

Water and air move through the upper part of the Goss soil at a moderately rapid rate and through the lower part at a moderate rate. They move through the Alford soil at a moderate rate. Surface runoff is very rapid. The subsoil is mainly medium acid or very strongly acid, but the lower part of the subsoil in the Goss soil ranges to neutral. Organic-matter content is low in the

surface layer of both soils. Natural fertility is low in the Goss soil and medium in the Alford soil. Available water capacity is low in the Goss soil and high in the Alford soil. Slopes facing south are somewhat more droughty than those facing north. The penetration of roots is restricted by the cherty fragments in the Goss soil.

Most areas are native woodland. These soils have poor potential for most uses but have fair potential for woodland and for woodland wildlife habitat.

The Goss soil is poorly suited and the Alford soil very well suited to woodland. The equipment limitation and a severe erosion hazard are the main problems in managing these soils as woodland. Trees adequately protect the soils against erosion, but areas exposed by logging are rapidly eroded. Logging trails and roads should be established on the contour if possible, and bare areas should be seeded after logging. Diverting surface water away from haul roads and skid trails helps to control erosion. The steep and very steep slopes hinder the equipment used in cutting and removing logs, but special equipment and safety precautions can overcome this limitation.

Because they are steep and very steep, these soils are generally unsuited as sites for buildings, local roads and streets, and waste disposal systems. Other limitations are the coarse fragments and bedrock, possible soil creep, and shrinking and swelling of the more clayey material. The cherty material is suitable as roadfill or as material supporting footings. The hazard of erosion is severe, and revegetating exposed areas is difficult. Special design, layout, and construction methods are needed. The cost may be prohibitive.

Capability subclass VIIs.

940E—Zanesville-Westmore silt loams, 15 to 30 percent slopes. This map unit consists of strongly sloping and moderately steep, moderately well drained and well drained soils on long hillsides adjacent to drainageways or bottom land. Individual areas are mainly long or round and range from about 20 to 500 acres in size. They are about 30 to 70 percent Zanesville soil and 25 to 45 percent Westmore soil. The Zanesville soil is on the upper and mid parts of side slopes and convex spur ridges. The Westmore soil is on the lower part of slopes, along lateral drainageways, and in some places above and below bedrock escarpments. The two soils occupy the same hillsides on a mostly wooded, dissected landscape and have not been separated in mapping.

Typically, the Zanesville soil has a dark grayish brown, very dark grayish brown, and yellowish brown silt loam surface layer about 6 inches thick. The subsoil is about 47 inches thick. The upper part is dominantly strong brown silt loam. The lower part is a dense and brittle fragipan. It is mainly brown silt loam that has pale brown streaks and has common sand grains and stones and boulders. The substratum to a depth of about 65 inches is mixed strong brown and grayish brown silt loam. It has common sand grains and scattered stones and boulders.

Typically, the Westmore soil has a dark grayish brown and yellowish brown silt loam surface layer about 6 inches thick. The subsoil is silty clay loam about 52 inches thick. The upper 14 inches is yellowish brown, and the lower 38 inches is mainly light brownish gray and gray. The substratum to a depth of about 62 inches is mixed brownish yellow and light gray silty clay.

Included with these soils in mapping are stony areas along drainageways and directly above and below bedrock escarpments, narrow areas of Burnside soil on bottom land along small streams, and less sloping areas, commonly on the convex spur ridges and on some of the foot slopes. Also included are small areas of Alford and Hosmer soils, which contain no coarse fragments to a depth of more than 50 inches. Included areas make up about 10 to 15 percent of this unit.

Water and air move through the upper part of the Zanesville and Westmore soils at a moderate rate and through the lower part of the subsoil at a moderately slow rate. Surface runoff is rapid. The subsoil of the Zanesville soil ranges from medium acid to very strongly acid. In the Westmore soil, the upper part of the subsoil is medium acid or strongly acid and the lower part ranges from very strongly acid to mildly alkaline. Organic-matter content is low in the surface layer. Natural fertility is low. Available water capacity is moderate in the Zanesville soil and moderate or high in the Westmore soil. The penetration of roots is restricted in the Zanesville soil by the fragipan and in the Westmore soil by the clayey lower part of the subsoil. Water is commonly perched on the fragipan in the Zanesville soil during rainy periods.

Most areas are native woodland. These soils have poor potential for cultivated crops and fair potential for hay and pasture. They have good potential for woodland and for woodland wildlife habitat. The potential for recreation uses, building site development, and sanitary facilities is poor.

These soils are suited to pasture. In the less sloping areas they are suitable as hayland, but the steeper slopes limit the use of equipment. Also, stones and boulders are evident in some areas. Erosion is a severe hazard. Pasture rotation, proper stocking rates, and restricted grazing during wet periods keep the pasture and the soil in good condition.

These soils are suited to woodland. In many areas they support stands of trees. Competing vegetation, the erosion hazard, and the equipment limitation are the main concerns of management. Competing vegetation can be controlled or removed by harvesting mature trees, thinning, cutting cull trees, and weeding. In some areas planting or harvesting is difficult because of the slope, the stones, and the bedrock escarpments. The soils are easily eroded if exposed during logging operations. Diverting surface water away from haul roads and

skid trails helps to control erosion. Planting on the contour and in a plant cover or mulch helps to control erosion before the seedlings are established.

In most areas these soils are rolling or hilly and support native vegetation. Bedrock escarpments are on many side slopes. Also, the water in streams and drainageways commonly cascades over stones and ledges. Carefully planned trails or paths can be constructed for hiking and sightseeing. Control of erosion is needed.

Because they are strongly sloping and moderately steep, these soils are generally unsuited as sites for buildings, local roads and streets, and waste disposal systems. Extensive cutting and filling and extensive land shaping generally are needed. The slope is less restrictive on the convex spur ridges and some of the foot slopes. Erosion is a severe hazard in disturbed areas. Laying out developments on the contour generally reduces the amount of cutting or filling that is needed. It also reduces the erosion hazard. Special design, layout, and construction methods are needed for buildings. The cost may be prohibitive.

Capability subclass VIe.

954E—Alford-Baxter complex, 15 to 30 percent slopes. This map unit consists of strongly sloping and moderately steep, well drained soils on hillsides adjacent to drainageways or bottom land. Individual areas are long or oval and range from about 10 to 200 acres in size. They are about 50 to 70 percent Alford soil and 25 to 40 percent Baxter soil. The Alford soil is on the mid and upper parts of slopes, and the Baxter soil is on the lower part of slopes and along drainageways. These soils occupy the same hillsides, generally on a wooded, dissected landscape, and have not been separated in mapping.

Typically, the Alford soil has a dark brown and light yellowish brown silt loam surface layer about 9 inches thick. The subsoil is strong brown silt loam or silty clay loam about 40 inches thick. The substratum to a depth of about 60 inches is brown silt loam. In places a thin, compact and brittle layer is in the lower part of the subsoil.

Typically, the Baxter soil has a dark brown cherty silt loam surface layer about 2 inches thick. The subsurface layer is about 13 inches thick. The upper part is pale brown cherty silt loam, and the lower part is light yellowish brown very cherty silt loam. The subsoil to a depth of about 70 inches is mainly red cherty silty clay and cherty clay. In places the surface layer is silt loam.

Included with these soils in mapping are bands of a soil that is 20 to 40 inches deep to cherty material. Also included are areas of the Elsah soil along narrow bottom land, some areas on the lower slopes where limestone crops out, and some sinkholes. Included areas make up about 10 to 15 percent of this unit.

Water and air move through these soils at a moderate rate, and surface runoff is rapid. Organic-matter content is low in the surface layer. Natural fertility is medium in the Alford soil and low in the Baxter soil. Available water capacity is high in the Alford soil and moderate in the Baxter soil. The penetration of plant roots is restricted by the cherty fragments and the high content of clay in the Baxter soil.

Most areas are woodland or pasture. These soils have poor potential for cultivated crops and fair potential for hay or pasture. The potential for woodland and for woodland wildlife habitat is good. The potential for recreation uses, building site development, and sanitary facilities is poor.

These soils are suited to pasture. In the less sloping areas they are suited to hay, but the steeper slopes limit the use of equipment. Erosion is a severe hazard. Pasture rotation, proper stocking rates, and restricted grazing during wet periods keep the pasture and the soil in good condition.

These soils are well suited to woodland. In many areas they support stands of trees. Competing vegetation, the erosion hazard, and the equipment limitation are the main concerns of management. Competing vegetation can be controlled or removed by harvesting mature trees, thinning, weeding, and cutting cull trees. The slope and the limestone outcrops in places restrict planting or harvesting. The soils are easily eroded if exposed during logging operations. Diverting surface water away from haul roads and skid trails helps to control erosion. Planting trees on the contour and in a plant cover or mulch helps to prevent excessive erosion before the seedlings are established. Restricting the use of equipment during wet periods helps to prevent compaction of the surface layer.

In most areas these soils are rolling or hilly and wooded. The setting favors picnicking, hiking, and similar activities. Carefully planned trails or paths can be constructed for sightseeing and hiking. The hazard of erosion, however, is severe, and erosion control is needed.

Because they are strongly sloping and moderately steep, these soils are generally unsuited as sites for buildings, local roads and streets, and waste disposal systems. Extensive cutting and filling and extensive land shaping generally are needed. Subsidence can occur in the sinkholes. The erosion hazard is severe. Special design, layout, and construction methods are needed. The cost may be prohibitive.

Capability subclass VIe.

977F—Wellston-Neotoma complex, 20 to 35 percent slopes. This map unit consists of moderately steep and steep, well drained soils on hillsides in the uplands. Individual areas are long or oval and range from about 20 to 100 acres in size. They are about 35 to 60 percent Wellston soil and 20 to 55 percent Neotoma soil. The Wellston soil is generally on the upper slopes on convex spur ridges between drainageways. The Neotoma soil is on the lower part of the slopes along drainageways and

in places on slopes along bedrock escarpments. The proportion of the Neotoma soil is generally higher on south-facing slopes than on north-facing slopes. The two soils occupy the same hillsides on a dissected, wooded landscape and have not been separated in mapping.

Typically, the Wellston soil has a dark grayish brown and pale brown silt loam surface layer about 9 inches thick. The subsoil is about 31 inches thick. The upper part is mainly strong brown silt loam, and the lower part is strong brown very channery silty clay loam. The substratum to a depth of about 60 inches is multicolored very channery loam. In places a thin, compact and brittle layer is in the lower part of the subsoil.

Typically, the Neotoma soil has a very dark grayish brown and dark grayish brown stony silt loam surface layer about 3 inches thick. The subsurface layer is dark brown flaggy silt loam about 7 inches thick. The subsoil is about 26 inches thick. The upper part is yellowish brown and strong brown flaggy silt loam. The lower part of the subsoil and the substratum to a depth of about 48 inches are multicolored very channery loam. Sandstone and siltstone bedrock that has thin bands of shale is at a depth of about 48 inches. In places no stony or flaggy coarse fragments are in the surface layer or the upper part of the subsoil.

Included with these soils in mapping are areas where boulders and rock ledges are common and some areas where bands of clayey material that weathered from shale are evident. Also included are small areas of the more silty Zanesville soils, which have a fragipan; a few areas where limestone bedrock is evident; and some areas of Burnside soils on narrow bottom land next to small stream channels. Included areas make up about 10 to 15 percent of this unit.

Water and air move through the Wellston soil at a moderate rate and through the Neotoma soil at a moderately rapid rate. Surface runoff is rapid or very rapid. The subsoil of both soils ranges from medium acid to extremely acid. Organic-matter content is low in the surface layer. Natural fertility is medium in the Wellston soil and low in the Neotoma soil. Available water capacity is high in the Wellston soil and low in the Neotoma soil. The coarse fragments throughout the Neotoma soil and in the lower part of the subsoil in the Wellston soil restrict root growth.

Nearly all areas support native hardwoods. These soils have poor potential for most uses but have fair potential for woodland and for woodland wildlife habitat.

These soils generally are well suited or very well suited to woodland. The Wellston soil on slopes facing south and west, however, is only moderately well suited to woodland. The equipment limitation and the erosion hazard are the main concerns of management. The moderately steep and steep slope, the stones, and the bedrock escarpments hinder planting and harvesting equipment. If the soils are exposed, the hazard of erosion is severe. Establishing logging roads and trails on the contour helps to control erosion. Diverting surface water away from haul roads and skid trails also helps to control erosion. Bare areas should be seeded with grasses and legumes.

These soils are mainly on long slopes that have a significant range in elevation. Generally, the slopes are wooded and have bedrock escarpments. Also, the water in many of the drainageways or streams cascades over stones and ledges. The rugged landscape is an appealing setting for hiking and sightseeing, particularly in autumn, when boulders and escarpments show through the colorful hardwood foliage.

Because of the moderately steep and steep slope, the stoniness, and the shallowness to bedrock, these soils are generally unsuited as sites for buildings, local roads and streets, and waste disposal systems. Special design, layout, and construction methods are needed for buildings. The cost may be prohibitive.

Capability subclass VIIs.

1334—Birds silt loam, wet. This nearly level, poorly drained soil is mainly on broad flats or in depressional areas on the wider bottom land. It is subject to frequent flooding for long periods in spring. Individual areas are mainly long or round and range from about 5 to 200 acres in size.

Typically, the surface layer is light brownish gray silt loam about 11 inches thick. The substratum to a depth of about 60 inches is light gray or gray silt loam that has reddish mottles. In places the lower part of the substratum has strata of silty clay loam. In some areas strongly acid layers are in the substratum.

Included with this soil in mapping are slightly higher areas of the somewhat poorly drained Wakeland soil. Also included are small areas of the somewhat clayey Piopolis soil. Included soils make up about 10 to 15 percent of this unit.

Water and air move through this soil at a moderately slow rate, and surface runoff is ponded. The seasonal high water table is at or near the surface. Organic-matter content is low in the surface layer. Natural fertility is medium. Available water capacity is high.

Most areas are native hardwood. This soil has fair potential for woodland and poor potential for cultivated crops, hay, and pasture. The potential for woodland and wetland wildlife habitat is good. The potential for recreation uses, building site development, and sanitary facilities is poor.

This soil is generally unsuited to corn, soybeans, and grain sorghum because it is wet. Shallow ditches can provide drainage if adequate outlets are available.

This soil is suitable as pastureland and hayland if species that are tolerant of wet sites are selected. Timely deferment of grazing, restricted use during wet periods, and proper stocking rates improve the condition of the pasture and the soil.

This soil is suited to woodland. The equipment limitation is severe and seedling mortality moderate because the soil is wet. In most areas trees can be planted during dry periods if species tolerant of wet sites are selected. Competing vegetation can be removed by thinning or by cutting cull trees. Restricting the use of equipment during wet periods prevents compaction of the surface layer.

Many areas provide habitat for wetland wildlife. Some shallow water areas are evident, and many others could be developed easily. The wetness limits the choice of plants that can be grown to provide food for wetland wildlife. This soil is well suited as habitat for woodland wildlife if it is left in native vegetation.

Because of the wetness and the flood hazard, this soil is generally unsuited as a site for buildings and waste disposal systems. Providing a system of levees and pumps or filling in the area can help to overcome these limitations.

Capability subclass Vw.

1426—Karnak silty clay, wet. This nearly level, very poorly drained soil is on broad flats and in narrow depressions on flood plains. It is subject to frequent flooding for long periods in spring. Individual areas are mainly long and narrow or oblong and range from about 5 to more than 200 acres in size.

Typically, the surface layer is dark gray silty clay about 8 inches thick. The subsoil is dark gray silty clay about 44 inches thick. The substratum to a depth of about 60 inches is gray silty clay. In some areas the subsoil or substratum has strata of silty clay loam.

Included with this soil in mapping are areas near overflow channels where silty overwash is evident and small areas of Cairo soils on slight rises. Cairo soils are loamy within a depth of 40 inches. Also included are some areas where the subsoil has slightly acid to mildly alkaline layers. Included areas make up about 10 to 15 percent of this unit.

Water and air move through this soil at a very slow rate. Surface runoff is ponded. The seasonal high water table is at or near the surface for extended periods in most years. The subsoil is medium acid or strongly acid. The surface layer is very hard when dry and very sticky when wet. Clods form if the soil is worked when wet. This very clayey soil shrinks during dry periods and swells during wet periods. Organic-matter content is low in the surface layer. Natural fertility is low or medium. Available water capacity is moderate. The penetration of roots is restricted by the fluctuating water level and by the high content of clay.

Most areas are woodland. A few areas are pastured. This soil has poor potential for cultivated crops and hay. It has fair potential for pasture and woodland and good to fair potential for wetland and woodland wildlife habitat. The potential for recreation uses, building site development, and sanitary facilities is poor.

This soil generally is not suited to cultivated crops or hay because of the extended seasonal wetness and the overflow hazard. A few areas are pastured. Grasses and legumes that can tolerate wet sites should be selected. Restricted use during wet periods, timely deferment of grazing, and proper stocking rates improve the condition of the pasture and the soil.

The soil is well suited to woodland. Seedling mortality, plant competition, and the equipment limitation are problems. Plant competition can be controlled by harvesting mature trees, thinning, and cutting cull trees. Most areas can be hand planted during the drier periods. Trees that are tolerant of wet sites should be selected.

Many areas provide habitat for wetland or woodland wildlife. Some shallow water areas are evident, and many others could be developed. The wetness limits the choice of plants that can be grown as food for wildlife.

The soil has serious limitations as a site for buildings, local roads and streets, and waste disposal systems. Because it is depressional, it is subject to ponding for long periods and to overflow during rainy periods. Providing adequate drainage is difficult because water moves very slowly through the soil and the soil is in a low-lying position on the landscape.

Capability subclass Vw.

3071—Darwin silty clay, frequently flooded. This nearly level, poorly drained and very poorly drained soil is on broad flats and in overflow channels on the flood plain of the Mississippi River. It is in the unprotected area between the levee and the river. It is subject to frequent flooding for long periods in winter and spring. Individual areas are mainly long and range from about 15 to 200 acres in size.

Typically, the surface layer is very dark gray silty clay about 8 inches thick. The subsoil is very dark gray and dark gray silty clay about 19 inches thick. The substratum to a depth of about 63 inches is dark gray, stratified silty clay and silty clay loam. In places the surface layer is silty clay loam. In some areas the substratum has strata of clay loam, loam, or fine sandy loam.

Included with this soil in mapping are areas where sandy or silty overwash is on the surface. Also included are areas of Cairo soils on similar or higher positions and areas of the somewhat poorly drained Medway soils on slight ridges. Included areas make up about 10 to 15 percent of this unit.

Water and air move through this soil at a very slow rate, and surface runoff is slow to ponded. The subsoil and substratum are slightly acid to moderately alkaline. The seasonal high water table is within 2 feet of the surface in winter and spring. The surface layer is very firm and difficult to till. It is very sticky when wet and very hard when dry. Clods form if the surface soil is worked when wet. The soil swells during wet periods and shrinks during dry periods. Organic-matter content and natural

fertility are medium. Available water capacity is moderate.

Most areas are cultivated. Some are wooded. This soil has poor potential for cultivated crops, hay, and pasture. It has fair potential for trees, poor potential for recreation uses, and good potential for wetland wildlife habitat. The potential for building site development and sanitary facilities is poor.

This soil generally is not suited to cultivated crops because it is frequently flooded in winter and spring. Annual summer crops, such as soybeans or grain sorghum, are planted in most areas. Flooding late in spring and early in fall is the main concern of management. Poor tilth and wetness are additional concerns. Planting early maturing crops reduces the risk of damage by floodwater. Conservation tillage and the return of crop residue to the soil improve tilth. Shallow ditches are effective in removing excess surface water.

This soil is moderately well suited to woodland. Seedling mortality and the equipment limitation are problems. Flooding and deposition result in some damage to seedlings. Flooding can delay or interrupt planting and logging.

Building site development, local roads, and onsite waste disposal systems generally are unsuitable on this soil because of the frequent flooding. Overcoming the flooding is not practical in most areas.

Capability subclass Vw.

3092—Sarpy fine sand, frequently flooded. This nearly level to gently sloping, excessively drained soil is on ridges and natural levees on the flood plain of the Mississippi River. It is in the unprotected area between the levee and the river. It is subject to frequent flooding in winter and spring. Individual areas are long and range from about 5 to 30 acres in size.

Typically, this soil has a recently deposited surface layer of light gray fine sand about 6 inches thick. The subsurface layer is about 4 inches of brown loamy fine sand. The substratum to a depth of about 60 inches is brown loamy fine sand over yellowish brown, stratified loamy fine sand and fine sandy loam. In places the recent sandy deposition is not evident. In some areas the substratum has bands of loam and silt loam.

Included with this soil in mapping are a few areas where slopes are short and steep. Also included, in swales or slight depressions, are the well drained loamy Ware soils and the somewhat poorly drained silty Medway soils. Included areas make up about 10 to 15 percent of this unit.

Water and air move through this soil at a rapid rate, and surface runoff is slow. Organic-matter content and natural fertility are low. Available water capacity also is low. The surface layer is loose or very friable and can be tilled easily. It dries quickly after rains and warms up early in spring.

Most areas support recently established trees and shrubs. This soil has fair potential for cultivated crops and pasture. It has poor potential for woodland and for wildlife habitat. It generally has poor potential for recreation uses, building site development, and sanitary facilities.

Because of the frequent flooding and scouring in winter and spring, this soil is generally suited only to annual summer crops, such as soybeans or grain sorghum. Planting early maturing crops reduces the risk of damage by floodwater. Flooding late in spring and early in fall and droughtiness in summer are the main concerns of management.

Grasses and legumes are suited to this soil. They are seldom planted, however, because of the flooding.

This soil is unsuited as a site for buildings, local roads, and waste disposal systems because of the frequent flooding.

Capability subclass IVw.

3456—Ware fine sandy loam, frequently flooded. This nearly level and gently sloping, moderately well drained soil is on ridges and natural levees on the flood plain of the Mississippi River. It is in the unprotected area between the levee and the river. It is subject to frequent flooding for brief periods in fall and spring. Individual areas are mainly long and range from about 15 to 300 acres in size.

Typically, the surface layer is dark grayish brown and pale brown fine sandy loam and loam about 7 inches thick. Beneath this is a layer of dark grayish brown and dark gray, stratified silty clay loam and silt loam about 9 inches thick. The substratum to a depth of about 60 inches is mainly brown, stratified loam, very fine sandy loam, and loamy fine sand. In some areas the substratum is mainly loamy fine sand.

Included with this soil in mapping are areas of a loose fine sand and areas where slopes are short and steep. Also included are areas of the more clayey Medway soil in depressions. Included areas make up about 10 to 15 percent of this unit.

Water and air move through the upper part of this soil at a moderate rate and through the more sandy substratum at a moderately rapid rate. Surface runoff is slow. Below the surface layer, reaction is mildly alkaline or moderately alkaline. The seasonal high water table is at a depth of 4 to 6 feet in spring. The surface layer is very friable and can be tilled easily. It dries out quickly after rains and warms up early in spring. It is medium in content of organic matter. Natural fertility is medium. Available water capacity is moderate.

Most areas are cultivated or support native stands of trees. This soil has poor potential for cultivated crops, hay, and pasture and good potential for woodland and for openland or woodland wildlife habitat. The potential for recreation uses, building site development, and sanitary facilities is poor.

This soil is poorly suited to corn, soybeans, and grain sorghum. Flooding early in fall or late in spring is the main concern of management. Floodwater severely damages crops during the growing season in some years. Planting short-season crops reduces the risk of damage.

This soil is poorly suited to woodland. Flooding and deposition can result in damage to seedlings. Flooding can delay or interrupt planting and logging. Because of the frequent flooding, this soil is generally unsuited as a site for buildings, local roads and streets, and waste disposal systems. Overcoming the flood hazard is not feasible in most areas.

Capability subclass IVw.

3590—Cairo silty clay, frequently flooded. This poorly drained soil, which is mainly nearly level but also is gently sloping, is in the unprotected area between the levee and the Mississippi River. It is subject to frequent flooding for long periods in winter and spring. Individual areas are mainly long and range from about 10 to 100 acres in size.

Typically, the surface layer is very dark gray silty clay about 11 inches thick. The subsoil is about 21 inches of dark grayish brown and dark gray light silty clay. The substratum to a depth of about 68 inches is brown very fine sandy loam over mixed grayish brown, gray, and brown strata of loam and silty clay loam. In places the surface layer is silty clay loam.

Included with this soil in mapping are areas along overflow channels where loamy overwash is evident and a few areas where slopes are short and steep. Also included are areas of the somewhat less clayey Medway soils on slight rises and slightly depressional areas of Darwin soils. The Darwin soils are generally more than 50 inches deep over loamy material. Included areas make up about 10 to 15 percent of this unit.

Water and air move through the clayey upper part of this soil at a very slow rate and through the sandy or loamy lower part at a moderately rapid rate. The subsoil ranges from slightly acid to mildly alkaline. The clayey surface layer is firm and difficult to till. It is sticky, and it clods if worked when wet. It cracks when dry. It is medium in content of organic matter. Natural fertility is medium or high. Available water capacity is moderate or high. The seasonal high water table is generally less than 1 foot from the surface.

Most areas are cultivated or remain native woodland. This soil has poor to fair potential for cultivated crops, hay, and pasture. It has fair to good potential for woodland and as habitat for wetland wildlife. The potential for recreation uses, building site development, and sanitary facilities is poor.

This soil is poorly suited to corn, soybeans, and grain sorghum. Flooding late in spring and early in fall is the main concern of management. Floodwater is likely to damage crops during the growing season in some years. Planting short-season crops reduces the risk of damage. Tilth can be improved by conservation tillage and by returning crop residue to the surface layer or adding other organic material. Shallow ditches are effective in removing excess surface water.

If left in native vegetation, this soil is well suited to woodland wildlife habitat. If cleared, it is well suited to the development of shallow water areas for waterfowl and other wetland wildlife.

Many areas remain in native hardwoods. This soil is well suited to woodland. Seedling mortality and the equipment limitation are problems. Compacting the clayey surface layer around roots is difficult. Hand planting commonly is needed for the best results. Flooding and deposition are likely to result in damage to seedlings and to delay or interrupt planting or harvesting.

This soil is generally unsuited as a site for buildings, local roads and streets, and waste disposal systems because of the flood hazard and the possibility of stream cutting and scouring.

Capability subclass IVw.

3682—Medway silty clay loam, frequently flooded. This nearly level and gently sloping, somewhat poorly drained soil is on narrow to broad, low ridges and natural levees in sloughs or overflow channels on the flood plain of the Mississippi River. It is in the unprotected area between the levee and the river. It is subject to frequent flooding for very brief periods in winter and spring. Individual areas are long or irregularly shaped and range from about 10 to 200 acres in size.

Typically, the surface layer is about 27 inches of very dark grayish brown silty clay loam that has thin strata of pale brown silt loam. The subsoil is about 8 inches of brown loam and dark gray silt loam. The substratum to a depth of about 60 inches is pale brown loamy very fine sand over strata of brown very fine sandy loam and loam. In places the surface layer is silt loam.

Included with this soil in mapping are areas along overflow channels where sandy overwash is evident and a few areas where slopes are short and steep. Also included are areas of Ware and Cairo soils. The moderately well drained Ware soil is on slight rises. It is more sandy than this Medway soil. The poorly drained Cairo soil is in similar or slightly depressional areas. It is more clayey in the upper part than the Medway soil. Included areas make up about 10 to 15 percent of this unit.

Water and air move through this soil at a moderate rate, and surface runoff is slow. The subsoil ranges from slightly acid to moderately alkaline. The seasonal high water table is at a depth of 1 1/2 to 3 feet in winter and spring. The surface layer is friable or firm. It generally can be tilled easily. It is medium or high in content of organic matter. Natural fertility is high. Available water capacity also is high.

Most areas are cultivated or remain native woodland. This soil has poor to fair potential for cultivated crops. The potential is good for woodland and fair to good for

woodland or openland wildlife habitat. It is poor for most recreation uses, for building site development, and for sanitary facilities.

This soil is moderately suited to soybeans, grain sorghum, and corn. The main concern of management is flooding late in spring and early in fall. Floodwater is likely to damage crops during the growing season in some years. Planting short-season crops reduces the risk of damage.

This soil is well suited to woodland. Seedlings can survive and grow well if plant competition is controlled by thinning, by weeding, and by cutting cull trees. Flooding and deposition can result in some damage to seedlings. Flooding can delay or interrupt planting or logging.

This soil is generally unsuited as a site for buildings, local roads or streets, and waste disposal systems because of the flood hazard. Overcoming the flood hazard is not feasible in most areas.

Capability subclass IVw.

4426—Karnak clay, ponded. This nearly level, very poorly drained soil is in depressions in flood plains, sloughs, or oxbows where water ponds for extended periods in most years. Most areas are long and narrow or elliptical and range from about 20 to 100 acres in size.

Typically, the surface layer is very dark grayish brown silty and mucky material about 5 inches thick. Below this is dark gray clay about 48 inches thick. The substratum to a depth of about 60 inches is gray silty clay loam. In some areas the subsoil has strata of silt loam or silty clay loam.

Water and air move very slowly through this soil. Surface runoff is ponded for long periods in most years. This very clayey soil shrinks in dry periods and swells in wet periods. Organic-matter content is high in the mucky surface layer. Natural fertility is low to medium. Available water capacity is high.

Because it is in depressions, has a high content of clay, and is ponded for long periods, this soil has poor potential for most uses. It has better potential for wetland wildlife habitat (fig. 9). In some spring-fed areas, water quality is high. These areas provide habitat for migratory fowl and for fish, turtles, and similar wetland wildlife.

Capability subclass VIIw.

5308D—Alford soils, karst, 2 to 20 percent slopes. These gently sloping to strongly sloping, well drained, slightly eroded to severely eroded soils are mainly on ridges between depressions and on the conical sides of the depressions associated with a karst terrain (fig. 10). Soil accumulates in the karst depressions or sinkholes that have an enclosed, concave or flat bottom. In the depressions or sinkholes that do not have an enclosed bottom, water drains into crevassed bedrock. Individual areas are mainly irregularly shaped and range from about 5 to 75 acres in size.

Typically, the surface layer is brown silt loam about 7 inches thick. The subsoil is strong brown silty clay loam about 36 inches thick. The substratum to a depth of about 60 inches is yellowish brown silt loam. In places a thin, compact and brittle layer is in the lower part of the subsoil. It has grayish streaks and mottles. In some areas the surface layer is silty clay loam. In wooded areas a dominantly very dark grayish brown surface layer overlies a brown subsurface layer.

Included with these soils in mapping are small areas of the moderately well drained Hosmer soils and areas on the floor of some of the depressions where the surface layer is thick. Also included is the cherty Baxter soil on the lower part of some of the steeper side slopes, particularly in areas where the sinkholes are not enclosed. Included areas make up about 10 to 15 percent of this unit.

Water and air move through these Alford soils at a moderate rate. Surface runoff is mainly medium to rapid and generally flows inward to the sinkholes. The subsoil ranges from medium acid to very strongly acid. Organic-matter content is low in the surface layer. Natural fertility is medium. Available water capacity is high. Plant roots readily penetrate these soils.

Most areas are used for pasture or woodland. These soils have poor potential for cultivated crops. They have fair potential for pasture, orchards, and woodland and for openland or woodland wildlife habitat. The potential for most recreation uses and for building site development is fair. The potential for sanitary facilities is poor.

These soils are poorly suited to cultivated crops because of the complex pattern of slopes. They are suited to fruit trees if excessive soil loss is prevented by an adequate plant cover.

In most areas these soils are well suited to pasture and hay. Proper stocking rates, rotation of grazing, and exclusion of livestock when the soils are wet keep the stand and the soil in good condition.

These soils are well suited to woodland. Some areas remain in native hardwoods. Planting on the contour and in a mulch or cover crop helps to prevent excessive soil loss before the seedlings are established. Plant competition can be controlled by harvesting mature trees, by thinning, by cutting cull trees, and by weeding. Restricting the use of equipment when the soils are wet helps to prevent compaction of the surface layer.

In many areas these soils are undulating to rolling and support native vegetation. Carefully planned trails or paths can be constructed for hiking and sightseeing. Control of erosion is needed.

Because further subsidence is a hazard, these soils generally are not suited as sites for buildings, local roads and streets, and waste disposal systems. Extensive cutting and filling and extensive land shaping generally are needed because the soils are gently sloping to strongly

sloping. The hazard of erosion is severe. The ground water supply is likely to be contaminated if the effluent from an onsite waste disposal system enters a sinkhole. Special design, layout, and construction methods are needed for buildings. The cost may be prohibitive.

Capability subclass IIIe.

Use and management of the soils

The soil survey is a detailed inventory and evaluation of the most basic resource of the survey area—the soil. It is useful in adjusting land use, including urbanization, to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in uses of the land.

While a soil survey is in progress, soil scientists, conservationists, engineers, and others keep extensive notes about the nature of the soils and about unique aspects of behavior of the soils. These notes include data on erosion, drought damage to specific crops, yield estimates, flooding, the functioning of septic tank disposal systems, and other factors affecting the productivity, potential, and limitations of the soils under various uses and management. In this way, field experience and measured data on soil properties and performance are used as a basis for predicting soil behavior.

Information in this section is useful in planning use and management of soils for crops and pasture, and woodland, as sites for buildings, highways and other transportation systems, sanitary facilities, and parks and other recreation facilities, and for wildlife habitat. From the data presented, the potential of each soil for specified land uses can be determined, soil limitations to these land uses can be identified, and costly failures in houses and other structures, caused by unfavorable soil properties, can be avoided. A site where soil properties are favorable can be selected, or practices that will overcome the soil limitations can be planned.

Planners and others using the soil survey can evaluate the impact of specific land uses on the overall productivity of the survey area or other broad planning area and on the environment. Productivity and the environment are closely related to the nature of the soil. Plans should maintain or create a land-use pattern in harmony with the natural soil.

Contractors can find information that is useful in locating sources of sand and gravel, roadfill, and topsoil. Other information indicates the presence of bedrock, wetness, or very firm soil horizons that cause difficulty in excavation.

Health officials, highway officials, engineers, and many other specialists also can find useful information in this soil survey. The safe disposal of wastes, for example, is closely related to properties of the soil. Pavements, sidewalks, campsites, playgrounds, lawns, and trees and shrubs are influenced by the nature of the soil.

Crops and pasture

Joe Barkley, district conservationist, Soil Conservation Service, helped prepare this section.

The major management concerns in the use of the soils for crops and pasture are described in this section. In addition, the crops or pasture plants best suited to the soil, including some not commonly grown in the survey area, are discussed; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are presented for each soil.

This section provides information about the overall agricultural potential of the survey area and about the management practices that are needed. The information is useful to equipment dealers, land improvement contractors, fertilizer companies, processing companies, planners, conservationists, and others. For each kind of soil, information about management is presented in the section "Soil maps for detailed planning." Planners of management systems for individual fields or farms should also consider the detailed information given in the description of each soil.

According to the Illinois Soil and Water Conservation Needs Inventory (*3*), in 1967 about 107,810 acres in Union County was cropland, 76,400 acres was woodland other than the Shawnee National Forest, and 38,185 acres was permanent pasture. The rest of the acreage was roads, levees, built-up areas, and other areas.

The soils in Union County have good potential for increased production of crops, particularly hay and pasture in the uplands. This soil survey can be used as a valuable guide to the latest management techniques that increase food and fiber production. It provides resource data necessary for wise land-use planning. Land-use planners and decisionmakers can use the information in this soil survey as a guide in making land-use decisions that will assure the orderly growth and development of town and country areas.

Soil erosion is the major problem on about 60 percent of the cropland and pastureland in Union County. It is a hazard if the slope is more than 6 percent. It can be a hazard if the slope is more than 1 percent and runoff is concentrated.

Sheet erosion, or loss of the surface layer, is damaging for three reasons. First, the productivity of most soils is reduced as the surface layer is eroded away and the subsoil is incorporated into a plow layer. Loss of the surface layer is especially damaging on those soils with a layer restricting root penetration. Such layers include the fragipan in Hosmer soils and the channery or flaggy layer in Wellston soils.

Second, severe erosion on sloping soils reduces the tilth of the surface soil and the intake of water. Clayey surface soil tends to be cloddy if it is worked when wet. Preparing a good seedbed is difficult on clayey soils.

These soils tend to crust after hard rains. As a result, runoff is increased.

Third, uncontrolled erosion allows sediment to enter streams, lakes, rivers, and road ditches. Cleaning out or removing this sediment is expensive. Management that controls erosion also reduces sediment pollution and improves water quality for municipal and recreation uses and for fish and wildlife.

A good management system maintains or improves natural fertility, removes excess water, controls erosion and soil blowing, and maintains good tilth. Reducing the length of slopes and providing an adequate plant cover help to control erosion and soil blowing. They also increase the rate of water intake and reduce runoff. A cropping system that keeps plant cover (fig. 11) and crop residue (fig. 12) on the surface during critical rainfall periods holds soil losses within tolerable limits and helps to maintain the productive capacity of the soil. Including grasses and legumes in the crop rotation improves tilth and provides nitrogen for the following crop.

Contour farming, contour stripcropping, terraces, and diversions help to control erosion and reduce the rate of runoff. As a result of the short slopes and the irregular topography, however, they are impractical in many areas of Hosmer and Alford soils. They are suitable in the areas of Hosmer and Alford soils where slopes are smooth and uniform. Some areas of Medway, Ware, and Cairo soils on bottom land along the Mississippi River are suitable for contouring or contour stripcropping, but these practices are not widely used in Union County. A conservation tillage system or a cropping rotation that provides adequate plant cover is needed to control erosion on these soils.

Zero tillage and minimum tillage help to prevent excessive soil loss, reduce runoff, and increase the rate of water intake. They are suitable on most of the tillable soils in the county but less successful on severely eroded soils and on soils that have a very clayey surface layer, such as Darwin, Jacob, Karnak, Cairo, and Bowdre soils.

Soil blowing is a hazard in some areas of Sarpy and Ware soils. The hazard can be reduced by maintaining a plant cover, leaving crop residue on the surface throughout the winter, or keeping the surface soil rough. Windbreaks of suitable trees or shrubs also are effective in controlling soil blowing.

Information about erosion control for each kind of soil is in the Technical Guide, available in local offices of the Soil Conservation Service.

Soil drainage is needed on about 20 percent of the acreage used for crops and pasture in the county. Some soils are naturally so wet that the production of crops commonly grown in the county generally is not possible unless drainage is provided. These are the poorly drained and very poorly drained Darwin, Jacob, Karnak, Cairo, Piopolis, and Birds soils on bottom land.

Unless drained, somewhat poorly drained soils are wet enough in some years that crop growth and productivity are reduced. Examples are the Dupo, Wakeland, and Banlic soils on bottom land.

Troublesome seepy spots are common on the Hosmer soils on hillsides or along lateral drainageways, especially in wet years. Draining or otherwise improving some of these spots, called "sodium slicks," is very difficult. Small areas of the wetter soils along drainageways and in swales are included with Hosmer and Alford soils in mapping. Artificial drainage is needed in some of these areas.

The design of surface and subsurface drainage systems varies with the kind of soil. Tile drains alone are inadequate on many soils. A combination of surface ditches and tile is needed in some areas of poorly drained and very poorly drained soils. Tile drains are not effective in slowly or very slowly permeable soils, such as Karnak, Cairo, Darwin, and Jacob soils, unless surface inlets are used to drain wet spots. Moderately and moderately slowly permeable soils, such as Gorham, Medway, Tice, Wakeland, and Birds, can be adequately drained by tile if outlets are available.

Surface drainage methods, such as ditching and land leveling, commonly drain excess water from most of the wet soils in the county. They are effective as long as the major rivers and streams do not flood. Additional care is needed to ensure that ditches are protected against silt deposition and bank erosion caused by runoff.

Information about the drainage system suitable for each kind of soil is contained in the Technical Guide, available in local offices of the Soil Conservation Service.

Soil droughtiness limits the productivity of some of the soils used for crops and pasture in the county. The physical composition of some soils limits the amount of available water, which is needed for the optimum growth of plants during dry periods. Sarpy and Burnside soils are examples. Other soils, such as Banlic and Hosmer, have layers or zones that cannot be easily penetrated by plant roots. These soils, particularly the severely eroded Hosmer soil, dry out quickly, and a moisture stress is soon evident during hot, windy days. A similar problem is evident on many of the wet clayey soils. Karnak and Jacob soils, for example, hold a large amount of water, but much of the water is not readily available to plant roots because it is tightly held as a film surrounding clay particles.

Increasing the rate of water intake, reducing the runoff rate, and planting crops that are drought tolerant help to overcome the adverse effects of droughtiness. The rate of water intake is increased and the rate of runoff decreased commonly by conservation tillage, the return of crop residue to the soil, additions of other organic material, and cover crops.

Such crops as soybeans and grain sorghum can withstand a limited water supply better than corn. As a

result, they are less risky in most years. Winter wheat also is better suited than corn because it matures in spring, before the summer droughtiness begins.

Soil fertility is naturally low to medium in most upland soils in the county. All are naturally acid. Reaction varies more in the soils on flood plains. Jacob and Piopolis soils are extremely acid to strongly acid, but Haymond, Wakeland, Cairo, Medway, Darwin, and Gorham soils are slightly acid to mildly alkaline.

On most acid soils applications of agricultural limestone are needed to maintain or raise the pH level and thereby obtain optimum plant growth.

Except for those soils having a thick, dark colored surface layer, such as Darwin, Cairo, and Medway soils, most of the soils in the county have a naturally low supply of nitrogen. Some crops, particularly corn and wheat, respond well to applications of nitrogen fertilizer. Planting legumes, which take nitrogen from the air and, through fixation, add it to the soil, and adding livestock waste help to replenish the nitrogen supply.

The dark colored soils on bottom land along the Mississippi River generally have a medium to high supply of available phosphorus and potassium. Most of the soils in the uplands have a low supply of phosphorus and a low to medium supply of potassium.

Additions of lime, nitrogen, phosphorus, potassium, or any other elements needed for optimum yields should be based on the results of soil tests. The Cooperative Extensive Service can help in determining the kinds and amounts of fertilizer and lime to apply after tests are made.

Soil tilth is an important factor in the germination of seeds, in the amount of runoff, and in the intake of water into the soil. Surface soil that is in good tilth is granular and porous.

Unless severely eroded, cropped soils in the uplands have a silt loam surface layer that is light in color and low in organic-matter content. Generally, the structure of these soils is weak and the surface crusts during periods of intense rainfall. Once the crust forms, it decreases the rate of water intake and increases the rate of runoff. Growing grasses and legumes and regularly adding crop residue, manure, or other organic material improve soil structure and reduce the likelihood of crusting.

Fall plowing generally is not suitable on the light colored soils that have a silty surface layer. Because a crust usually forms in winter and spring, many of these soils are nearly as compact and hard at planting time as they were before plowing. Many are sloping and thus can be damaged by erosion if they are fall plowed.

Poor tilth is a problem in the dark colored clayey Cairo and Darwin soils and the light colored clayey Karnak and Jacob soils. Also, these soils often stay wet until late in spring. If plowed when wet, they tend to be very cloddy. As a result, preparing a good seedbed is difficult. Tilling these soils in the fall generally can result in good tilth in the spring if crop residue is left on or directly below the surface.

Field crops suited to the soils and climate of the survey area include many that are not commonly grown. Soybeans and corn are the main crops. The acreage planted to grain sorghum is increasing. Sweet potatoes, white potatoes, green beans, and navy beans are suitable.

Wheat is the main close-growing crop. Oats, rye, and barley are grown in a few areas. Rice can be grown on the clayey soils on bottom land along the Mississippi River, but a high level of management is needed.

Sunflowers, pumpkins, and squash have been grown on various soils on bottom land along the Mississippi River, but the yields vary. Daffodils grow on a number of plots and could be grown commercially on soils in the uplands.

Union County ranks first in the State in the production of apples and peaches. The climate and the soils are particularly well suited to the expansion of the apple crop. Some strawberries, tomatoes, peppers, cucumbers, and blueberries also are grown commercially.

Yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. Absence of an estimated yield indicates that the crop is not suited to or not commonly grown on the soil.

The estimated yields were based mainly on the experience and records of farmers, conservationists, and extension agents (*8*). Results of field trials and demonstrations and available yield data from nearby counties were also considered.

The yields were estimated assuming that the latest soil and crop management practices were used. Hay and pasture yields were estimated for the most productive varieties of grasses and legumes suited to the climate and the soil. A few farmers may be obtaining average yields higher than those shown in table 5.

The management needed to achieve the indicated yields of the various crops depends on the kind of soil and the crop. Such management provides drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate tillage practices, including time of tillage and seedbed preparation and tilling when soil moisture is favorable; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residues, barnyard manure, and green-manure crops; harvesting crops with the smallest possible loss; and timeliness of all fieldwork.

The estimated yields reflect the productive capacity of the soils for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not included because the acreage of these crops is small. The local offices of the Soil Conservation Service and the Cooperative Extension Service can provide information about the management concerns and productivity of the soils for these crops.

Capability classes and subclasses

Capability classes and subclasses show, in a general way, the suitability of soils for most kinds of field crops. The soils are classed according to their limitations when they are used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops that require special management. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for forest trees or for engineering purposes.

In the capability system, all kinds of soil are grouped at three levels: capability class, subclass, and unit (*5*). The capability class and subclass are defined in the following paragraphs. A survey area may not have soils of all classes.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and landforms have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class; they are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

The capability subclass is identified in the description of each soil mapping unit in the section "Soil maps for detailed planning."

Woodland management and productivity

Hardwood forest originally covered all areas of Union County but some areas on bottom land along the Mississippi River. According to the Conservation Needs Inventory (*3*), about 76,400 acres in Union County was woodland in 1967. This acreage includes State forests and parks. Other wooded areas are those in the Shawnee National Forest.

Most of the trees were cleared from the soils suitable for cultivated crops. As a result, much of the remaining woodland is on soils that are unsuitable for cultivation. In many areas it is too steep, wet, stony, or remote for cultivated crops. The soils in the wooded areas have fair to good potential for trees of high quality if the best suited species are selected and the woodland is properly managed.

The largest areas of woodland are in soil associations 2, 5, 6, 7, and 8, which are described under the heading "General soil map for broad land-use planning." The most common desirable trees on uplands are white oak, red oak, black oak, hickory, black walnut, and yellow-poplar. The main species on bottom land are cottonwood, sycamore, sweetgum, pin oak, and pecan.

Much of the commercial woodland would benefit if trees were harvested as they matured and the nonmerchantable ones that retard the growth of desirable trees were removed. Protection from fire and grazing livestock is essential. Tree planting is needed unless stocking is adequate. Control of competing vegetation is needed if seedlings are planted. Grass cover between rows of seedlings that are planted on bare, sloping land helps to control erosion. Machinery can be used only if the soil is

firm enough to support the weight. If excessive erosion occurs or the slope is more than 15 percent, runoff should be diverted away from haul roads and skid trails. Surface drainage is beneficial on wet soils.

Table 6 contains information useful to woodland owners or forest managers planning use of soils for wood crops. Map unit symbols for soils suitable for wood crops are listed, and the ordination (woodland suitability) symbol for each soil is given. All soils bearing the same ordination symbol require the same general kinds of woodland management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for important trees. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *w* indicates excessive water in or on the soils, sandy texture; *f*, high content of coarse fragments in the profile; and *r*, steep slopes. The letter *o* indicates insignificant limitations or restrictions. If a soil has more than one limitation, priority in placing the soil into a limitation class is in the following order: w, s, f, and r.

In table 6 the soils are also rated for a number of factors to be considered in management. *Slight, moderate,* and *severe* are used to indicate the degree of major soil limitations.

Ratings of the *erosion hazard* indicate the risk of loss of soil in well managed woodland. The risk is *slight* if the expected soil loss is small, *moderate* if some measures are needed to control erosion during logging and road construction, and *severe* if intensive management or special equipment and methods are needed to prevent excessive loss of soil.

Ratings of *equipment limitation* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or equipment; *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Seedling mortality ratings indicate the degree that the soil affects expected mortality of planted tree seedlings. Plant competition is not considered in the ratings. Seedlings from good planting stock that are properly planted during a period of sufficient rainfall are rated. A rating of *slight* indicates that the expected mortality of the planted seedlings is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Considered in the ratings of *windthrow hazard* are characteristics of the soil that affect the development of tree roots and the ability of the soil to hold trees firmly. A rating of *slight* indicates that trees in wooded areas are not expected to be blown down by commonly occurring winds; *moderate*, that some trees are blown down during periods of excessive soil wetness and strong winds; and *severe*, that many trees are blown down during periods of excessive soil wetness and moderate or strong winds.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index*. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Important trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

Trees to plant are those that are suitable for commercial wood production and that are suited to the soils.

Windbreaks and environmental plantings

Windbreaks are established to protect livestock, buildings, and yards from wind and snow. Windbreaks also help protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broad-leaved and coniferous species provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field, the interval depending on erodibility of the soil. They protect cropland and crops from wind, hold snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. A healthy planting stock of suitable species planted properly on a well prepared site and maintained in good condition can insure a high degree of plant survival.

Table 7 shows the height that locally grown trees and shrubs are expected to reach on various kinds of soil in 20 years. The estimates in table 7 based on measurements and observation of established plantings that have been given adequate care, can be used as a guide in planning windbreaks and screens. Additional information about planning windbreaks and screens and the planting and care of trees can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from nurserymen.

Engineering

This section provides information about the use of soils for building sites, sanitary facilities, construction material, and water management. Among those who can benefit from this information are engineers, landowners, community planners, town and city managers, land de-

velopers, builders, contractors, and farmers and ranchers.

The ratings in the engineering tables are based on test data and estimated data in the "Soil properties" section. The ratings were determined jointly by soil scientists and engineers of the Soil Conservation Service using known relationships between the soil properties and the behavior of soils in various engineering uses.

Among the soil properties and site conditions identified by a soil survey and used in determining the ratings in this section were grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock that is within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure or aggregation, in-place soil density, and geologic origin of the soil material. Where pertinent, data about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of absorbed cations were also considered.

On the basis of information assembled about soil properties, ranges of values can be estimated for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, shear strength, compressibility, slope stability, and other factors of expected soil behavior in engineering uses. As appropriate, these values can be applied to each major horizon of each soil or to the entire profile.

These factors of soil behavior affect construction and maintenance of roads, airport runways, pipelines, foundations for small buildings, ponds and small dams, irrigation projects, drainage systems, sewage and refuse disposal systems, and other engineering works. The ranges of values can be used to (1) select potential residential, commercial, industrial, and recreational uses; (2) make preliminary estimates pertinent to construction in a particular area; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for location of sanitary landfills, onsite sewage disposal systems, and other waste disposal facilities; (5) plan detailed onsite investigations of soils and geology; (6) find sources of gravel, sand, clay, and topsoil; (7) plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; (8) relate performance of structures already built to the properties of the kinds of soil on which they are built so that performance of similar structures on the same or a similar soil in other locations can be predicted; and (9) predict the trafficability of soils for cross-country movement of vehicles and construction equipment.

Data presented in this section are useful for land-use planning and for choosing alternative practices or general designs that will overcome unfavorable soil properties and minimize soil-related failures. Limitations to the use of these data, however, should be well understood. First, the data are generally not presented for soil material below a depth of 5 or 6 feet. Also, because of the scale of the detailed map in this soil survey, small areas of soils that differ from the dominant soil may be included in mapping. Thus, these data do not eliminate the need for onsite investigations, testing, and analysis by personnel having expertise in the specific use contemplated.

The information is presented mainly in tables. Table 8 shows, for each kind of soil, the degree and kind of limitations for building site development; table 9, for sanitary facilities. Table 11 shows the kind of limitations for water management. Table 10 shows the suitability of each kind of soil as a source of construction materials.

The information in the tables, along with the soil map, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations and to construct interpretive maps for specific uses of land.

Some of the terms used in this soil survey have a special meaning in soil science. Many of these terms are defined in the Glossary.

Building site development

The degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping are indicated in table 8. A *slight* limitation indicates that soil properties generally are favorable for the specified use; any limitation is minor and easily overcome. A *moderate* limitation indicates that soil properties and site features are unfavorable for the specified use, but the limitations can be overcome or minimized by special planning and design. A *severe* limitation indicates that one or more soil properties or site features are so unfavorable or difficult to overcome that a major increase in construction effort, special design, or intensive maintenance is required. For some soils rated severe, such costly measures may not be feasible.

Shallow excavations are made for pipelines, sewerlines, communications and power transmission lines, basements, open ditches, and cemeteries. Such digging or trenching is influenced by soil wetness caused by a seasonal high water table; the texture and consistence of soils; the tendency of soils to cave in or slough; and the presence of very firm, dense soil layers, bedrock, or large stones. In addition, excavations are affected by slope of the soil and the probability of flooding. Ratings do not apply to soil horizons below a depth of 6 feet unless otherwise noted.

In the soil series descriptions, the consistence of each soil horizon is given, and the presence of very firm or extremely firm horizons, usually difficult to excavate, is indicated.

Dwellings and *small commercial buildings* referred to in table 8 are built on undisturbed soil and have foundation loads of a dwelling no more than three stories high. Separate ratings are made for small commercial buildings without basements and for dwellings with and with-

out basements. For such structures, soils should be sufficiently stable that cracking or subsidence of the structure from settling or shear failure of the foundation does not occur. These ratings were determined from estimates of the shear strength, compressibility, and shrink-swell potential of the soil. Soil texture, plasticity and in-place density, soil wetness, and depth to a seasonal high water table were also considered. Soil wetness and depth to a seasonal high water table indicate potential difficulty in providing adequate drainage for basements, lawns, and gardens. Depth to bedrock, slope, and large stones in or on the soil are also important considerations in the choice of sites for these structures and were considered in determining the ratings. Susceptibility to flooding is a serious hazard.

Local roads and streets referred to in table 8 have an all-weather surface that can carry light to medium traffic all year. They consist of a subgrade of the underlying soil material; a base of gravel, crushed rock fragments, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. The roads are graded with soil material at hand, and most cuts and fills are less than 6 feet deep.

The load supporting capacity and the stability of the soil as well as the quantity and workability of fill material available are important in design and construction of roads and streets. The classifications of the soil and the soil texture, density, shrink-swell potential, and potential frost action are indicators of the traffic supporting capacity used in making the ratings. Soil wetness, flooding, slope, depth to hard rock or very compact layers, and content of large stones affect stability and ease of excavation.

Lawns and landscaping require soils that are suitable for the establishment and maintenance of turf for lawns and ornamental trees and shrubs for landscaping. The best soils are firm after rains, are not dusty when dry, and absorb water readily and hold sufficient moisture for plant growth. The surface layer should be free of stones. If shaping is required, the soils should be thick enough over bedrock or hardpan to allow for necessary grading. In rating the soils, the availability of water for sprinkling is assumed.

Sanitary facilities

Favorable soil properties and site features are needed for proper functioning of septic tank absorption fields, sewage lagoons, and sanitary landfills. The nature of the soil is important in selecting sites for these facilities and in identifying limiting soil properties and site features to be considered in design and installation. Also, those soil properties that affect ease of excavation or installation of these facilities will be of interest to contractors and local officials. Table 9 shows the degree and kind of limitations of each soil for such uses and for use of the soil as daily cover for landfills. It is important to observe local ordinances and regulations.

If the degree of soil limitation is expressed as *slight*, soils are generally favorable for the specified use and limitations are minor and easily overcome; if *moderate*, soil properties or site features are unfavorable for the specified use, but limitations can be overcome by special planning and design; and if *severe*, soil properties or site features are so unfavorable or difficult to overcome that major soil reclamation, special designs, or intensive maintenance is required. Soil suitability is rated by the terms *good*, *fair*, or *poor*, which, respectively, mean about the same as the terms *slight*, *moderate*, and *severe*.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into the natural soil. Only the soil horizons between depths of 18 and 72 inches are evaluated for this use. The soil properties and site features considered are those that affect the absorption of the effluent and those that affect the construction of the system.

Properties and features that affect absorption of the effluent are permeability, depth to seasonal high water table, depth to bedrock, and susceptibility to flooding. Stones, boulders, and shallowness to bedrock interfere with installation. Excessive slope can cause lateral seepage and surfacing of the effluent. Also, soil erosion and soil slippage are hazards if absorption fields are installed on sloping soils.

In some soils, loose sand and gravel or fractured bedrock is less than 4 feet below the tile lines. In these soils the absorption field does not adequately filter the effluent, and ground water in the area may be contaminated.

On many of the soils that have moderate or severe limitations for use as septic tank absorption fields, a system to lower the seasonal water table can be installed or the size of the absorption field can be increased so that performance is satisfactory.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons have a nearly level floor and cut slopes or embankments of compacted soil material. Aerobic lagoons generally are designed to hold sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water. Soils that are very high in content of organic matter and those that have cobbles, stones, or boulders are not suitable. Unless the soil has very slow permeability, contamination of ground water is a hazard where the seasonal high water table is above the level of the lagoon floor. In soils where the water table is seasonally high, seepage of ground water into the lagoon can seriously reduce the lagoon's capacity for liquid waste. Slope, depth to bedrock, and susceptibility to flooding also affect the suitability of sites for sewage lagoons or the cost of construction. Shear strength and permeability of

compacted soil material affect the performance of embankments.

Sanitary landfill is a method of disposing of solid waste by placing refuse in successive layers either in excavated trenches or on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil material. Landfill areas are subject to heavy vehicular traffic. Risk of polluting ground water and trafficability affect the suitability of a soil for this use. The best soils have a loamy or silty texture, have moderate to slow permeability, are deep to a seasonal water table, and are not subject to flooding. Clayey soils are likely to be sticky and difficult to spread. Sandy or gravelly soils generally have rapid permeability, which might allow noxious liquids to contaminate ground water. Soil wetness can be a limitation, because operating heavy equipment on a wet soil is difficult. Seepage into the refuse increases the risk of pollution of ground water.

Ease of excavation affects the suitability of a soil for the trench type of landfill. A suitable soil is deep to bedrock and free of large stones and boulders. If the seasonal water table is high, water will seep into trenches.

Unless otherwise stated, the limitations in table 9 apply only to the soil material within a depth of about 6 feet. If the trench is deeper, a limitation of slight or moderate may not be valid. Site investigation is needed before a site is selected.

Daily cover for landfill should be soil that is easy to excavate and spread over the compacted fill in wet and dry periods. Soils that are loamy or silty and free of stones or boulders are better than other soils. Clayey soils may be sticky and difficult to spread; sandy soils may be subject to soil blowing.

The soils selected for final cover of landfills should be suitable for growing plants. Of all the horizons, the A horizon in most soils has the best workability, more organic matter, and the best potential for growing plants. Thus, for either the area- or trench-type landfill, stockpiling material from the A horizon for use as the surface layer of the final cover is desirable.

Where it is necessary to bring in soil material for daily or final cover, thickness of suitable soil material available and depth to a seasonal high water table in soils surrounding the sites should be evaluated. Other factors to be evaluated are those that affect reclamation of the borrow areas. These factors include slope, erodibility, and potential for plant growth.

Construction materials

The suitability of each soil as a source of roadfill, sand, gravel, and topsoil is indicated in table 10 by ratings of good, fair, or poor. The texture, thickness, and organic-matter content of each soil horizon are important factors in rating soils for use as construction materials. Each soil is evaluated to the depth observed, generally about 6 feet.

Roadfill is soil material used in embankments for roads. Soils are evaluated as a source of roadfill for low embankments, which generally are less than 6 feet high and less exacting in design than high embankments. The ratings reflect the ease of excavating and working the material and the expected performance of the material where it has been compacted and adequately drained. The performance of soil after it is stabilized with lime or cement is not considered in the ratings, but information about some of the soil properties that influence such performance is given in the descriptions of the soil series.

The ratings apply to the soil material between the A horizon and a depth of 5 to 6 feet. It is assumed that soil horizons will be mixed during excavation and spreading. Many soils have horizons of contrasting suitability within their profile. The estimated engineering properties in table 14 provide specific information about the nature of each horizon. This information can help determine the suitability of each horizon for roadfill.

Soils rated *good* are coarse grained. They have low shrink-swell potential and few cobbles and stones. They are at least moderately well drained and have slopes of 15 percent or less. Soils rated *fair* have a plasticity index of less than 15 and have other limiting features, such as moderate shrink-swell potential, moderately steep slopes, wetness, or many stones. If the thickness of suitable material is less than 3 feet, the entire soil is rated *poor*.

Sand and *gravel* are used in great quantities in many kinds of construction. The ratings in table 10 provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand or gravel. A soil rated *good* or *fair* has a layer of suitable material at least 3 feet thick, the top of which is within a depth of 6 feet. Coarse fragments of soft bedrock material, such as shale and siltstone, are not considered to be sand and gravel. Fine-grained soils are not suitable sources of sand and gravel.

The ratings do not take into account depth to the water table or other factors that affect excavation of the material. Descriptions of grain size, kinds of minerals, reaction, and stratification are given in the soil series descriptions and in table 14.

Topsoil is used in areas where vegetation is to be established and maintained. Suitability is affected mainly by the ease of working and spreading the soil material in preparing a seedbed and by the ability of the soil material to support plantlife. Also considered is the damage that can result at the area from which the topsoil is taken.

The ease of excavation is influenced by the thickness of suitable material, wetness, slope, and amount of stones. The ability of the soil to support plantlife is deter-

mined by texture, structure, and the amount of soluble salts or toxic substances. Organic matter in the A1 or Ap horizon greatly increases the absorption and retention of moisture and nutrients. Therefore, the soil material from these horizons should be carefully preserved for later use.

Soils rated *good* have at least 16 inches of friable loamy material at their surface. They are free of stones and cobbles, are low in content of gravel, and have gentle slopes. They are low in soluble salts that can limit or prevent plant growth. They are naturally fertile or respond well to fertilizer. They are not so wet that excavation is difficult during most of the year.

Soils rated *fair* are loose sandy soils or firm loamy or clayey soils in which the suitable material is only 8 to 16 inches thick or soils that have appreciable amounts of gravel, stones, or soluble salt.

Soils rated *poor* are very sandy soils and very firm clayey soils; soils with suitable layers less than 8 inches thick; soils having large amounts of gravel, stones, or soluble salt; steep soils; and poorly drained soils.

Although a rating of *good* is not based entirely on high content of organic matter, a surface horizon is generally preferred for topsoil because of its organic-matter content. This horizon is designated as A1 or Ap in the soil series descriptions. The absorption and retention of moisture and nutrients for plant growth are greatly increased by organic matter.

Water management

Many soil properties and site features that affect water management practices have been identified in this soil survey. In table 11 the soil and site features that affect use are indicated for each kind of soil. This information is significant in planning, installing, and maintaining water-control structures.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have a low seepage potential, which is determined by permeability and the depth to fractured or permeable bedrock or other permeable material.

Embankments, dikes, and levees require soil material that is resistant to seepage, erosion, and piping and has favorable stability, shrink-swell potential, shear strength, and compaction characteristics. Large stones and organic matter in a soil downgrade the suitability of a soil for use in embankments, dikes, and levees.

Drainage of soil is affected by such soil properties as permeability; texture; depth to bedrock, hardpan, or other layers that affect the rate of water movement; depth to the water table; slope; stability of ditchbanks; susceptibility to flooding; salinity and alkalinity; and availability of outlets for drainage.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to intercept runoff. They allow water to soak into the soil or flow slowly to an outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to bedrock, hardpan, or other unfavorable material; large stones; permeability; ease of establishing vegetation; and resistance to water erosion, soil blowing, soil slipping, and piping.

Grassed waterways are constructed to channel runoff to outlets at a nonerosive velocity. Features that affect the use of soils for waterways are slope, permeability, erodibility, wetness, and suitability for permanent vegetation.

Recreation

There is an increasing demand in the county for land and facilities for outdoor recreational activities, including boating, swimming, picnicking, fishing, hunting, hiking, bird watching, and camping. Many acres of public forests, lakes, and parks are available for recreation uses. Shawnee National Forest, Giant City State Park (fig. 13), Union County Wildlife Refuge, Dongola Lake, Union State Tree Nursery and Forest, Larue-Pine Hills Ecological Area, and Laura and Grassy Lakes furnish most of the available facilities.

A limited acreage in the Alford association has good potential for most recreation uses. The soils in this association have a slope of 2 to 6 percent and are not flooded. A larger acreage, mainly in the Alford and Hosmer associations, has fair potential for most recreation uses. The major limitations are the slope, which ranges from 6 to 12 percent, and wetness.

Many areas in the Hosmer-Zanesville, Alford-Wellston, and Goss-Alford associations and some areas in the Hosmer and Alford associations have poor potential for most recreation uses. The major limitation is the slope, which ranges from 12 to 70 percent. Most areas in the Wakeland-Haymond, Karnak-Darwin-Jacob, and Ware-Medway associations have poor potential for most recreation uses. The major problems are flooding and wetness.

The soils of the survey area are rated in table 12 according to limitations that affect their suitability for recreation uses. The ratings are based on such restrictive soil features as flooding, wetness, slope, and texture of the surface layer. Not considered in these ratings, but important in evaluating a site, are location and accessibility of the area, size and shape of the area and its scenic quality, the ability of the soil to support vegetation, access to water, potential water impoundment sites available, and either access to public sewerlines or capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited, in varying degree, for recreation use by the duration and intensity of flooding and the season when flooding occurs. Onsite assessment of height, duration, intensity, and frequency of flooding is essential in planning recreation facilities.

The degree of the limitation of the soils is expressed as slight, moderate, or severe. *Slight* means that the soil properties are generally favorable and that the limitations are minor and easily overcome. *Moderate* means that the limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 12 can be supplemented by information in other parts of this survey. Especially helpful are interpretations for septic tank absorption fields, given in table 9, and interpretations for dwellings without basements and for local roads and streets, given in table 8.

Camp areas require such site preparation as shaping and leveling for tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils for this use have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing camping sites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for use as picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that will increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones or boulders, is firm after rains, and is not dusty when dry. If shaping is required to obtain a uniform grade, the depth of the soil over bedrock or hardpan should be enough to allow necessary grading.

Paths and trails for walking, horseback riding, bicycling, and other uses should require little or no cutting and filling. The best soils for this use are those that are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once during the annual period of use. They have moderate slopes and have few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have a surface that is free of stones and boulders and have moderate slopes. Suitability of the soil for traps, tees, or greens was not considered in rating the soils. Irrigation is an assumed management practice.

Wildlife habitat

Soils directly affect the kind and amount of vegetation that is available to wildlife as food and cover, and they affect the construction of water impoundments. The kind and abundance of wildlife that populate an area depend largely on the amount and distribution of food, cover, and water. If any one of these elements is missing, is inadequate, or is inaccessible, wildlife either are scarce or do not inhabit the area.

If the soils have the potential, wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by helping the natural establishment of desirable plants.

In table 13, the soils in the survey area are rated according to their potential to support the main kinds of wildlife habitat in the area. This information can be used in planning for parks, wildlife refuges, nature study areas, and other developments for wildlife; selecting areas that are suitable for wildlife; selecting soils that are suitable for creating, improving, or maintaining specific elements of wildlife habitat; and determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* means that the element of wildlife habitat or the kind of habitat is easily created, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected if the soil is used for the designated purpose. A rating of *fair* means that the element of wildlife habitat or kind of habitat can be created, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* means that limitations are severe for the designated element or kind of wildlife habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* means that restrictions for the element of wildlife habitat or kind of wildlife are very severe, and that unsatisfactory results can be expected. Wildlife habitat is impractical or even impossible to create, improve, or maintain on soils having such a rating.

The elements of wildlife habitat are briefly described in the following paragraphs.

Grain and seed crops are seed-producing annuals used by wildlife. The major soil properties that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, milo, and soybeans.

Grasses and legumes are domestic perennial grasses and herbaceous legumes that are planted for wildlife

food and cover. Major soil properties that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, orchardgrass, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds, that provide food and cover for wildlife. Major soil properties that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, ragweed, beggarweed, broomsedge, and partridgepea.

Hardwood trees and the associated woody understory provide cover for wildlife and produce nuts or other fruit, buds, catkins, twigs, bark, or foliage that wildlife eat. Major soil properties that affect growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of native plants are oak, poplar, cherry, blackgum, apple, hawthorn, dogwood, hickory, blackberry, and blueberry. Examples of fruit-producing shrubs that are commercially available and suitable for planting on soils rated *good* are Russian-olive, autumn-olive, and crabapple.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites, exclusive of submerged or floating aquatics. They produce food or cover for wildlife that use wetland as habitat. Major soil properties affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, wildrice, cattail, and cordgrass and rushes, sedges, and reeds.

Shallow water areas are bodies of water that have an average depth of less than 5 feet and that are useful to wildlife. They can be naturally wet areas, or they can be created by dams or levees or by water-control structures in marshes or streams. Major soil properties affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. The availability of a dependable water supply is important if water areas are to be developed. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The kinds of wildlife habitat are briefly described in the following paragraphs.

Openland habitat consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The kinds of wildlife attracted to these areas include bobwhite quail, meadowlark, field sparrow, cottontail rabbit, and red fox.

Woodland habitat consists of areas of hardwoods or conifers, or a mixture of both, and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, and deer.

Wetland habitat consists of open, marshy or swampy, shallow water areas where water-tolerant plants grow. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, mink, and beaver.

Union County provides a variety of habitat for wildlife, including forests, pastureland, extensive bottom land areas, bluffs, and wetlands. The wildlife also is varied. There are good populations of white-tailed deer, wild turkey, gray squirrels, fox squirrels, rabbits, bobwhite quail, and furbearers and many nongame birds, mammals, amphibians, and reptiles. Wetland areas and streams support waterfowl, wading birds, shore birds, mink, muskrat, and a few river otters.

Wildlife habitat is not a primary land use in most areas. Wildlife is a primary crop only on land especially set aside as wildlife habitat. It is a secondary crop on soils used for grain, hay and pasture, and forest.

The paragraphs that follow specify, by the soil associations described under the heading "General soil map for broad land-use planning," the kinds of habitat in three wildlife areas in Union County and the kinds of wildlife in those areas.

Wildlife Area 1.—This wildlife area is on the Wakeland-Haymond, Karnak-Darwin-Jacob, and Ware-Medway associations. It is mainly on the flood plain of the Mississippi River. The soils are nearly level and gently sloping and range from very poorly drained to well drained. Most of the Wakeland-Haymond association is subject to flooding.

Many wetlands, including shrub swamps and wooded swamps, on the Karnak-Darwin-Jacob association are highly productive as wildlife habitat. Such areas as the Union County Conservation Area and Larue Swamp, a part of Larue-Pine Hills Ecological Area, provide habitat and refuge for rare or uncommon species, such as river otter, bobcat, green water snake, western bird-voiced treefrog, and mole salamander. Two rare fishes, the bantam sunfish and the banded pigmy sunfish, inhabit spring-fed swamps in the northwestern part of the county. A flock of almost 100,000 geese winters in the Union County Conservation Area and uses the cropland on the Ware-Medway and Wakeland-Haymond associations as a feeding site. Goose hunting is an important source of income for landowners on these associations.

The major wildlife species in this area, in addition to the geese, are raccoon, white-tailed deer, wild turkey, ducks, muskrats, shore birds, wading birds, and other nongame species. Migrant bald eagles sometimes inhabit the area in winter.

Wildlife Area 2.—This wildlife area is on the Goss-Alford association. It is along the bluff overlooking the flood plain of the Mississippi River and is characterized

by rock outcrops and steep bluffs. The Ozark Hills Nature Preserve and the Pine Hills part of Larue-Pine Hills Ecological Area are included in this wildlife area. The soils are moderately steep to very steep, well drained, and generally forested.

The bluffs provide habitat for eastern wood rat, a rare species in Illinois, and are denning areas for rattlesnakes and other snakes. This wildlife area is important as habitat for wild turkey and is one of the better locations in the State for turkey hunting. It is part of the only known range of scarlet snake and northern black-tail shiner in Illinois, and it provides habitat for spring cavefish and northern flat-headed snake, both of which have a very restricted range in the State.

Other important wildlife in this area are white-tailed deer, gray squirrel, raccoon and other furbearers, and numerous species of nongame birds, mammals, and reptiles. The wildlife can benefit from good timberland management, protection from fire, and exclusion of grazing livestock.

Wildlife Area 3.—This wildlife area is on the Hosmer, Hosmer-Zanesville, Alford-Wellston, and Alford associations. It extends over most of the eastern half of the county. The soils dominantly are gently sloping to steep and moderately well drained and well drained.

Most of the acreage is pasture, cropland, or woodland. As a result of the interspersion of pasture, cropland, and woodland, this wildlife area provides excellent habitat for small game species, such as bobwhite quail, rabbit, fox squirrel, and mourning dove, and for white-tailed deer. Other species include gray squirrel, wild turkey, furbearers, and some nongame animals. Numerous farm ponds provide good fishing for bass, bluegill, and channel catfish. Many of the streams also support good populations of fishes. Pasture management, crop residue management, and protection of woodland from fire and grazing have an important effect on the area as a habitat for wildlife.

Soil properties

Extensive data about soil properties are summarized on the following pages. The two main sources of these data are the many thousands of soil borings made during the course of the survey and the laboratory analyses of selected soil samples from typical profiles.

In making soil borings during field mapping, soil scientists identify several important soil properties. They note the seasonal soil moisture condition or the presence of free water and its depth. For each horizon in the profile, they note the thickness and color of the soil material; the texture, or amount of clay, silt, sand, and gravel or other coarse fragments; the structure, or the natural pattern of cracks and pores in the undisturbed soil; and the consistence of the soil material in place under the existing soil moisture conditions. They record the depth of plant roots, determine the pH or reaction of the soil, and identify any free carbonates.

Samples of soil material are analyzed in the laboratory to verify the field estimates of soil properties and to determine all major properties of key soils, especially properties that cannot be estimated accurately by field observation. Laboratory analyses are not conducted for all soil series in the survey area, but laboratory data for many soil series not tested are available from nearby survey areas.

The available field and laboratory data are summarized in tables. The tables give the estimated range of engineering properties, the engineering classifications, and the physical and chemical properties of each major horizon of each soil in the survey area. They also present data about pertinent soil and water features and engineering test data.

Engineering properties

Table 14 gives estimates of engineering properties and classifications for the major horizons of each soil in the survey area.

Most soils have, within the upper 5 or 6 feet, horizons of contrasting properties. Table 14 gives information for each of these contrasting horizons in a typical profile. *Depth* to the upper and lower boundaries of each horizon is indicated. More information about the range in depth and about other properties in each horizon is given for each soil series in the section "Soil series and morphology."

Texture is described in table 14 in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loam." Other texture terms are defined in the Glossary.

The two systems commonly used in classifying soils for engineering use are the Unified Soil Classification System (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO) (*1*).

The *Unified* system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter, plasticity index, liquid limit, and organic-matter content. Soils are grouped into 15 classes—eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two

classes have a dual classification symbol, for example, CL-ML.

The *AASHTO* system classifies soils according to those properties that affect their use in highway construction and maintenance. In this system a mineral soil is classified in one of seven basic groups ranging from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines. At the other extreme, in group A-7, are fine-grained soils. Highly organic soils are classified in group A-8 on the basis of visual inspection.

When laboratory data are available, the A-1, A-2, and A-7 groups are further classified as follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, and A-7-6. As an additional refinement, the desirability of soils as subgrade material can be indicated by a group index number. These numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The AASHTO classification for soils tested in the survey area, with group index numbers in parentheses, is given in table 17. The estimated classification, without group index numbers, is given in table 14. Also in table 14 the percentage, by weight, of rock fragments more than 3 inches in diameter is estimated for each major horizon. These estimates are determined mainly by observing volume percentage in the field and then converting that, by formula, to weight percentage.

Percentage of the soil material less than 3 inches in diameter that passes each of four sieves (U.S. standard) is estimated for each major horizon. The estimates are based on tests of soils that were sampled in the survey area and in nearby areas and on field estimates from many borings made during the survey.

Liquid limit and *plasticity index* indicate the effect of water on the strength and consistence of soil. These indexes are used in both the Unified and AASHTO soil classification systems. They are also used as indicators in making general predictions of soil behavior. Ranges in liquid limit and plasticity index are estimated on the basis of test data from the survey area or from nearby areas and on observations of the many soil borings made during the survey.

In some surveys, the estimates are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterburg limits extend a marginal amount across classification boundaries (1 or 2 percent), the classification in the marginal zone is omitted.

Physical and chemical properties

Table 15 shows estimated values for several soil characteristics and features that affect behavior of soils in engineering uses. These estimates are given for each major horizon, at the depths indicated, in the typical pedon of each soil. The estimates are based on field observations and on test data for these and similar soils.

Permeability is estimated on the basis of known relationships among the soil characteristics observed in the field—particularly soil structure, porosity, and gradation or texture—that influence the downward movement of water in the soil. The estimates are for vertical water movement when the soil is saturated. Not considered in the estimates is lateral seepage or such transient soil features as plowpans and surface crusts. Permeability of the soil is an important factor to be considered in planning and designing drainage systems, in evaluating the potential of soils for septic tank systems and other waste disposal systems, and in many other aspects of land use and management.

Available water capacity is rated on the basis of soil characteristics that influence the ability of the soil to hold water and make it available to plants. Important characteristics are content of organic matter, soil texture, and soil structure. Shallow-rooted plants are not likely to use the available water from the deeper soil horizons. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design of irrigation systems.

Soil reaction is expressed as a range in pH values. The range in pH of each major horizon is based on many field checks. For many soils, the values have been verified by laboratory analyses. Soil reaction is important in selecting the crops, ornamental plants, or other plants to be grown; in evaluating soil amendments for fertility and stabilization; and in evaluating the corrosivity of soils.

Shrink-swell potential depends mainly on the amount and kind of clay in the soil. Laboratory measurements of the swelling of undisturbed clods were made for many soils. For others the swelling was estimated on the basis of the kind and amount of clay in the soil and on measurements of similar soils. The size of the load and the magnitude of the change in soil moisture content also influence the swelling of soils. Shrinking and swelling of some soils can cause damage to building foundations, basement walls, roads, and other structures unless special designs are used. A high shrink-swell potential indicates that special design and added expense may be required if the planned use of the soil will not tolerate large volume changes.

Erosion factors are used to predict the erodibility of a soil and its tolerance to erosion in relation to specific kinds of land use and treatment. The soil erodibility factor (K) is a measure of the susceptibility of the soil to erosion by water. Soils having the highest K values are the most erodible. K values range from 0.10 to 0.64. To estimate annual soil loss per acre, the K value of a soil is modified by factors representing plant cover, grade and length of slope, management practices, and climate. The soil-loss tolerance factor (T) is the maximum rate of soil erosion, whether from rainfall or soil blowing, that can occur without reducing crop production or environmental quality. The rate is expressed in tons of soil loss per acre per year.

Organic matter is plant and animal residue in the soil at various stages of decomposition. In table 15 the content of organic matter in the surface layer is estimated as a percent of the soil material that is less than 2 millimeters in diameter.

Organic matter affects the available water capacity, infiltration rate, and tilth of the soil. It is a source of nitrogen and other nutrients for crops. The content of organic matter can be increased by returning crop residue to the soil.

Soil and water features

Table 16 contains information helpful in planning land uses and engineering projects that are likely to be affected by soil and water features.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are placed in one of four groups on the basis of the intake of water after the soils have been wetted and have received precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist chiefly of deep, well drained to excessively drained sands or gravels. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils that have a layer that impedes the downward movement of water or soils that have moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clay soils that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding is the temporary covering of soil with water from overflowing streams or with runoff from adjacent slopes (fig. 14). Water standing for short periods after rains or after snow melts is not considered flooding, nor is water in swamps and marshes. Flooding is rated in general terms that describe the frequency and duration of flooding and the time of year when flooding is most likely. The ratings are based on evidence in the soil profile of the effects of flooding, namely thin strata of gravel, sand, silt, or, in places, clay deposited by floodwater; irregular decrease in organic-matter content with increasing depth; and absence of distinctive soil horizons that form in soils of the area that are not subject to flooding. The ratings are also based on local information about floodwater levels in the area and the extent of flooding and on information that relates the position of each soil on the landscape to historic floods.

The generalized description of flood hazards is of value in land-use planning and provides a valid basis for land-use restrictions. The soil data are less specific, however, than those provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table is the highest level of a saturated zone more than 6 inches thick for a continuous period of more than 2 weeks during most years. The depth to a seasonal high water table applies to undrained soils. Estimates are based mainly on the relationship between grayish colors or mottles in the soil and the depth to free water observed in many borings made during the course of the soil survey. Indicated in table 16 are the depth to the seasonal high water table; the kind of water table, that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. Only saturated zones above a depth of 5 or 6 feet are indicated.

Information about the seasonal high water table helps in assessing the need for specially designed foundations, the need for specific kinds of drainage systems, and the need for footing drains to insure dry basements. Such information is also needed to decide whether or not construction of basements is feasible and to determine how septic tank absorption fields and other underground installations will function. Also, a seasonal high water table affects ease of excavation.

Depth to bedrock is shown for all soils that are underlain by bedrock at a depth of 5 to 6 feet or less. For many soils, the limited depth to bedrock is a part of the definition of the soil series. The depths shown are based on measurements made in many soil borings and on other observations during the mapping of the soils. The kind of bedrock and its hardness as related to ease of excavation is also shown. Rippable bedrock can be excavated with a single-tooth ripping attachment on a 200-horsepower tractor, but hard bedrock generally requires blasting.

Potential frost action refers to the likelihood of damage to pavements and other structures by frost heaving and low soil strength after thawing. Frost action results from the movement of soil moisture into the freezing temperature zone in the soil, which causes ice lenses to form. Soil texture, temperature, moisture content, porosity, permeability, and content of organic matter are the most important soil properties that affect frost action. It is assumed that the soil is not covered by insulating vegetation or snow and is not artificially drained. Silty and clayey soils that have a high water table in winter are most susceptible to frost action. Well

drained very gravelly or sandy soils are the least susceptible.

Risk of corrosion pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to soil moisture, particle-size distribution, total acidity, and electrical conductivity of the soil material. The rate of corrosion of concrete is based mainly on the sulfate content, texture, and acidity of the soil. Protective measures for steel or more resistant concrete help to avoid or minimize damage resulting from the corrosion. Uncoated steel intersecting soil boundaries or soil horizons is more susceptible to corrosion than an installation that is entirely within one kind of soil or within one soil horizon.

Engineering test data

The results of analyses of engineering properties of several typical soils of the survey area are given in table 17.

The data presented are for soil samples that were collected from carefully selected sites. The soil profiles sampled are typical of the series discussed in the section "Soil series and morphology." The soil samples were analyzed by the Illinois State Department of Transportation.

The methods used in obtaining the data are listed by code in the next paragraph. Most of the codes, in parentheses, refer to the methods assigned by the American Association of State Highway and Transportation Officials. The code for Unified classification is assigned by the American Society for Testing and Materials.

The methods and codes are AASHTO classification (M-145-66); Unified classification (D-2487-69); mechanical analysis (T88-57); liquid limit (T89-60); plasticity index (T90-56); and moisture-density, method A (T99-57).

Soil series and morphology

In this section, each soil series recognized in the survey area is described in detail. The descriptions are arranged in alphabetic order by series name.

Characteristics of the soil and the material in which it formed are discussed for each series. The soil is then compared to similar soils and to nearby soils of other series. Then a pedon, a small three-dimensional area of soil that is typical of the soil series in the survey area, is described. The detailed descriptions of each soil horizon follow standards in the Soil Survey Manual (*4*). Unless otherwise noted, colors described are for moist soil.

Following the pedon description is the range of important characteristics of the soil series in this survey area. Phases, or map units, of each soil series are described in the section "Soil maps for detailed planning."

Alford series

The Alford series consists of well drained, moderately permeable soils formed in loess. These soils are on ridgetops and hillsides in the uplands. Slope ranges from 2 to 70 percent.

In this survey area Alford soils are commonly mapped with or are adjacent to Hosmer, Goss, Baxter, or Wellston soils. They are similar to Hosmer and Wellston soils but lack the Bx horizon characteristic of Hosmer soils and the coarse fragments in the lower part of the solum characteristic of Wellston soils. Goss and Baxter soils contain more clay in the B2t horizon than Alford soils and contain more coarse fragments in the solum.

Typical pedon of Alford silt loam, 2 to 6 percent slopes, eroded, about 1,650 feet west and 660 feet south of the northeast corner of sec. 7, T. 13 S., R. 1 W., in a cultivated field:

Ap—0 to 8 inches; dark brown (10YR 4/3) silt loam; weak medium granular structure; friable; slightly acid; abrupt smooth boundary.

B21t—8 to 18 inches; brown (7.5YR 5/4) silty clay loam; weak medium subangular blocky structure; firm; continuous thin dark brown (7.5YR 4/4) clay films on faces of peds; strongly acid; clear smooth boundary.

B22t—18 to 28 inches; brown (7.5YR 5/4) silty clay loam; moderate coarse and medium subangular blocky structure; firm; continuous thin dark brown (7.5YR 5/4) clay films on faces of peds; strongly acid; clear smooth boundary.

B23t—28 to 39 inches; strong brown (7.5YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm; thin continuous brown (7.5YR 5/4) clay films and patches of light brown (7.5YR 6/4) uncoated silt grains on faces of peds; strongly acid; clear smooth boundary.

B24t—39 to 48 inches; strong brown (7.5YR 5/6) heavy silty clay loam; moderate medium subangular blocky structure; firm; thin patchy brown (7.5YR 5/4) clay films and pale brown (10YR 6/3) uncoated silt grains on faces of peds; strongly acid; gradual wavy boundary.

B3—48 to 63 inches; yellowish brown (10YR 5/6) silt loam; weak coarse subangular blocky structure; firm; thin patchy dark yellowish brown (10YR 4/4) clay films and patches of pale brown (10YR 6/3) uncoated silt grains on faces of peds; gradual wavy boundary.

C—63 to 70 inches; brown (7.5YR 5/4) silt loam; massive; friable; pale brown (10YR 6/3) uncoated silt grains in crevices of cleavage planes; medium acid.

The thickness of solum ranges from about 50 to 75 inches. Reaction ranges from medium acid to very strongly acid throughout the solum unless liming has reduced the acidity of the surface layer.

The Ap or A1 horizon is dominantly dark brown (10YR 4/3) or yellowish brown (10YR 5/4), but it is very dark grayish brown (10YR 3/2) in wooded areas. In some pedons the C horizon has mottles with chroma of 2 or lower.

Banlic series

The Banlic series consists of somewhat poorly drained, slowly permeable soils formed in silty alluvium. These soils are on slight rises on flood plains. Slope ranges from 0 to 3 percent.

Banlic soils are on the same flood plains as Birds, Haymond, and Wakeland soils. Unlike those soils, they have a Bx horizon. Birds soils have chroma of 2 or less in the upper part of the solum, and Haymond soils have browner chroma throughout the solum than Banlic soils.

Typical pedon of Banlic silt loam, 1,600 feet north and 20 feet west of the southeast corner of sec. 21, T. 11 S., R. 2 W., in a cultivated field:

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam; common fine faint grayish brown (10YR 5/2) and few fine faint dark yellowish brown (10YR 4/4) mottles; weak medium granular structure; friable; few dark concretions; strongly acid; abrupt smooth boundary.

A2—8 to 13 inches; dark grayish brown (10YR 4/2) silt loam; few fine distinct dark yellowish brown (10YR 4/4) and common medium faint grayish brown (10YR 5/2) mottles; weak medium subangular blocky or granular structure; friable; common light brownish gray (10YR 6/2) uncoated silt grains on faces of peds; few dark concretions; medium acid; clear smooth boundary.

B2—13 to 22 inches; brown (10YR 5/3) light silt loam; few medium distinct strong brown (7.5YR 5/6) mottles; weak coarse granular and weak medium subangular blocky structure; friable; light brownish gray (10YR 6/2) coatings on faces of peds; common large dark concretions; common krotovinas; very strongly acid; clear smooth boundary.

Bx1—22 to 28 inches; light grayish brown (10YR 6/2) silt; few fine distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable and slightly brittle; patchy white (5Y 8/1) silt grains on faces of peds; common dark concretions; very strongly acid; clear smooth boundary.

Bx2—28 to 35 inches; light brownish gray (2.5Y 6/2) silt; common fine distinct yellowish brown (10YR 5/6) mottles; weak fine prismatic structure parting to moderate subangular blocky; firm and brittle; patchy light gray (5Y 7/2) uncoated silt grains and patchy thin grayish brown (2.5Y 5/2) clay films on faces of peds; common fine dark concretions; very strongly acid; clear smooth boundary.

Bx3—35 to 48 inches; light brownish gray (2.5Y 6/2) silt loam; common fine distinct yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure parting to weak coarse subangular blocky; firm and brittle; patchy light gray (5Y 7/2) uncoated silt grains and thin patchy grayish brown (5Y 5/2) clay films on faces of peds; common fine to large dark concretions; very strongly acid; clear smooth boundary.

Cx1—48 to 60 inches; light brownish gray (2.5Y 6/2) silt loam; massive; firm and brittle; common light gray (5Y 7/2) uncoated silt grains on faces of peds; many dark stains and concretions; very strongly acid; gradual smooth boundary.

The thickness of solum ranges from about 45 to 65 inches. Depth to the Bx horizon ranges from 20 to 36 inches. The solum generally ranges from strongly acid to extremely acid. The surface layer, however, can be less acid. It is grayish brown (10YR 5/2), dark grayish brown (10YR 4/2), or dark brown (10YR 4/3).

Baxter series

The Baxter series consists of well drained, moderately permeable soils formed in residuum weathered from cherty limestone. These soils are on hillsides in the uplands. Slope ranges from 15 to 30 percent.

Baxter soils are on the same hillsides as Alford soils and are similar to Goss soils. Alford soils formed in loess and do not have the cherty coarse fragments or the clayey B2t horizon characteristic of Baxter soils. Goss soils contain more chert and have a higher base saturation than Baxter soils.

Typical pedon of Baxter cherty silt loam, in an area of Alford-Baxter complex, 15 to 30 percent slopes, about 2,000 feet south of the center of sec. 25, T. 13 S., R. 1 W., in a wooded area:

A1—0 to 2 inches; dark brown (10YR 4/3) cherty silt loam; weak and moderate fine granular structure; friable; 30 percent coarse fragments; medium acid; clear smooth boundary.

A21—2 to 7 inches; pale brown (10YR 6/3) cherty silt loam; weak fine granular structure; friable; 20 percent coarse fragments; strongly acid; gradual smooth boundary.

A22—7 to 15 inches; light yellowish brown (10YR 6/4) very cherty silt loam; weak fine granular structure; very friable; 75 percent coarse fragments; very strongly acid; clear wavy boundary.

B21t—15 to 22 inches; yellowish red (5YR 5/6) cherty silty clay loam; moderate fine subangular blocky structure; firm; continuous red (2.5YR 4/6) clay films on faces of peds; 40 percent coarse fragments; very strongly acid; gradual wavy boundary.

B22t—22 to 35 inches; red (2.5YR 4/6) cherty silty clay; common medium distinct yellowish red (5YR 6/6)

mottles; moderate fine angular blocky structure; very firm; continuous red (2.5YR 4/6) clay films on faces of peds; 25 percent coarse fragments; very strongly acid; gradual wavy boundary.

B23t—35 to 43 inches; red (2.5YR 4/8) cherty silty clay; weak medium angular blocky structure; very firm; continuous red (2.5YR 4/6) clay films on faces of peds; 15 percent coarse fragments; very strongly acid; gradual wavy boundary.

B24t—43 to 57 inches; red (2.5YR 4/8) cherty clay; common medium distinct yellowish red (7.5YR 5/6) and few fine prominent white (7.5YR 8/1) mottles; moderate medium angular blocky structure; very firm; continuous red (2.5YR 4/6) clay films on faces of peds; 20 percent coarse fragments; very strongly acid; gradual wavy boundary.

B25t—57 to 70 inches; red (2.5YR 4/8) cherty clay; many medium prominent yellowish red (7.5YR 6/6) mottles; moderate medium angular blocky structure; very firm; 40 percent coarse fragments; very strongly acid.

The solum is more than 60 inches thick. The content of clay in the upper 20 inches of the argillic horizon is more than 35 percent, and it increases with increasing depth. In most pedons the content of coarse fragments in the upper 20 inches of the argillic horizon ranges from 15 to 45 percent. In some pedons the A1 and A2 horizons are silt loam. The B2t horizon is very strongly acid or extremely acid.

Birds series

The Birds series consists of poorly drained, moderately slowly permeable soils formed in silty stream sediments. These soils are mainly in nearly level or depressional areas on the broader bottom land. Slope ranges from 0 to 2 percent.

Birds soils are on the same flood plains as Wakeland soils and are similar to Piopolis soils. They contain more clay in the control section than Wakeland soils and are more poorly drained. Piopolis soils contain more clay throughout the profile than Birds soils and are more acid in the solum.

Typical pedon of Birds silt loam, wet, about 1,050 feet south and 925 feet west of the northeast corner of sec. 24, T. 12 S., R. 1 E., in a field of forbs and grasses:

A1—0 to 11 inches; light brownish gray (10YR 6/2) silt loam; many medium distinct yellowish brown (10YR 5/4), strong brown (7.5YR 5/4), and gray (10YR 6/1) mottles; weak medium granular structure; friable; slightly acid; clear smooth boundary.

C1—11 to 17 inches; light gray (10YR 7/2) silt loam; few fine distinct reddish yellow (7.5YR 6/6) mottles; massive; friable; medium acid; gradual smooth boundary.

C2—17 to 30 inches; light gray (10YR 7/2) silt loam; common fine distinct reddish yellow (7.5YR 6/6) mottles; massive; friable; medium acid; gradual smooth boundary.

C3—30 to 60 inches; gray (10YR 6/1) silt loam; many fine prominent reddish yellow (7.5YR 6/6) and red (2.5YR 4/6) mottles; massive; friable; medium acid.

The A1 horizon is dark grayish brown (10YR 4/2), grayish brown (10YR 5/2), or light brownish gray (10YR 6/2). The C horizon is medium acid to neutral.

Bowdre series

The Bowdre series consists of somewhat poorly drained soils that are slowly permeable in the upper part and moderately permeable in the lower part. These soils formed in clayey and loamy sediments. They are mainly on ridges along sloughs in overflow channels on bottom land along the Mississippi River. Slope ranges from 1 to 6 percent.

Bowdre soils are commonly adjacent to Cairo, Darwin, Medway, Gorham, and Ware soils on the landscape. They are shallower to loamy material than Cairo and Darwin soils and have a less gray B horizon. They contain more clay in the B horizon than Medway, Gorham, and Ware soils.

Typical pedon of Bowdre silty clay, about 200 feet south and 335 feet east of the northwest corner of sec. 24, T. 11 S., R. 4 W., in a cultivated field:

Ap—0 to 5 inches; very dark grayish brown (10YR 3/2) silty clay; moderate medium granular structure; firm; very dark gray (10YR 3/1) exterior faces of peds; very dark grayish brown (10YR 3/2) kneaded color; few worm casts and channels; many roots; neutral; abrupt smooth boundary.

A12—5 to 11 inches; very dark grayish brown (10YR 3/2) silty clay; few fine faint dark yellowish brown (10YR 4/4) mottles; moderate fine and medium angular blocky structure; very firm; very dark grayish brown (2.5Y 3/2) faces of peds; very dark grayish brown (10YR 3/2) kneaded color; few worm casts and channels; common roots; neutral; abrupt wavy boundary.

B2—11 to 17 inches; dark brown (10YR 4/3) heavy silty clay loam; few fine faint dark yellowish brown (10YR 4/4) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; few dark grayish brown (10YR 4/2) clay films, discontinuous on vertical faces of peds; very dark gray (10YR 3/1) clay flows in worm holes; common roots; slightly acid; clear smooth boundary.

IIB3—17 to 23 inches; dark brown (10YR 4/3) loam; common medium distinct grayish brown (2.5Y 5/2) mottles; weak coarse subangular blocky structure; friable; thin patchy dark gray (10YR 4/1) clay films

on faces of some peds; common roots; slightly acid; clear smooth boundary.

IIC1—23 to 42 inches; dark brown (10YR 4/3) very fine sandy loam; common medium distinct grayish brown (2.5Y 5/2) and common fine faint dark yellowish brown (10YR 4/4) mottles; massive; very friable; common root and worm channels with dark gray (10YR 4/1) clay lining; many roots; neutral; clear wavy boundary.

IIC2—42 to 53 inches; brown (10YR 5/3) very fine sandy loam with thin strata of loam and silt loam; common fine distinct dark yellowish brown (10YR 4/4) mottles; few thin black (10YR 2/1) strata; massive; very friable; few roots; neutral; clear wavy boundary.

IIC3—53 to 60 inches; 50 percent grayish brown (10YR 5/2), 35 percent dark gray (10YR 4/1), and 15 percent brown (10YR 5/3), stratified very fine sandy loam, loam, and silt loam; massive; very friable; few roots; mildly alkaline.

Depth to the IIB3 horizon ranges from 12 to 20 inches. Reaction ranges from slightly acid to moderately alkaline throughout the profile.

The A horizon is dominantly silty clay, but in some pedons it is heavy silty clay loam or clay. The mollic epipedon is 8 to 14 inches thick. The B horizon is mottled with shades of brown or gray. The B2 horizon is silty clay or heavy silty clay loam. The IIB3 horizon is loam or silt loam. The IIC horizon is commonly very fine sandy loam or loamy very fine sand and can have strata of silty material.

Burnside series

The Burnside series consists of moderately well drained, moderately permeable soils formed in loamy stream sediments and the underlying channery or flaggy sediments. These soils are on narrow bottom land. Slope ranges from 0 to 4 percent.

Burnside soils are similar to Elsah soils and are on the same flood plains as Haymond and Wakeland soils. They are more acid than Elsah soils and also differ from those soils in containing coarse fragments of sandstone and siltstone rather than chert. They contain more coarse fragments within a depth of 40 inches than Haymond and Wakeland soils.

Typical pedon of Burnside loam, about 425 feet south and 2,620 feet west of the northeast corner of sec. 2, T. 11 S., R. 1 W., in a wooded area:

A11—0 to 3 inches; dark brown (10YR 4/3) loam; moderate fine granular structure; very friable; strongly acid; clear smooth boundary.

A12—3 to 14 inches; dark brown (10YR 4/3) loam; moderate fine granular structure; very friable; very strongly acid; gradual wavy boundary.

IIB2—14 to 22 inches; dark yellowish brown (10YR 4/4) channery loam; weak medium subangular blocky structure; very friable; 30 percent coarse fragments; very strongly acid; gradual wavy boundary.

IIC1—22 to 43 inches; dark yellowish brown (10YR 4/4) flaggy loam; massive; very friable; 45 percent coarse fragments; very strongly acid; gradual wavy boundary.

IIC2—43 to 63 inches; dark yellowish brown (10YR 4/4) very flaggy loam; massive; friable; 60 percent coarse fragments; very strongly acid; gradual irregular boundary.

R—63 to 69 inches; weathered sandstone with few thin bands of shale.

The depth to loamy-skeletal material ranges from 12 to 24 inches. The depth to bedrock ranges from 40 to 80 inches. The A horizon is dominantly loam but in some pedons is silt loam. It is 8 to 16 inches thick. The B horizon and the upper part of the C horizon range from 20 to 50 percent coarse fragments.

Cairo series

The Cairo series consists of poorly drained soils that are very slowly permeable in the upper part and rapidly permeable in the lower part. These soils formed in clayey material and in the loamy underlying material. They are on broad flats and low terraces on flood plains. Slope ranges from 1 to 5 percent.

The Cairo soils in Union County lack the abrupt shift in texture from clayey to sandy material that is definitive for the Cairo series. This difference, however, does not greatly alter the use or behavior of the soils.

Cairo soils are on the same flood plains as Bowdre, Darwin, Medway, and Gorham soils and are similar to those soils. They are more poorly drained than Bowdre soils and have a sandier substratum. They contain more sand below a depth of 40 inches than Darwin soils and more clay in the solum than Medway and Gorham soils.

Typical pedon of Cairo silty clay, about 1,773 feet south and 435 feet west of the northeast corner of sec. 17, T. 12 S., R. 3 W., in a cultivated field:

Ap—0 to 5 inches; black (2.5Y 2/2) silty clay; strong fine granular structure in upper 3 inches grading to weak medium angular blocky in lower part; firm, plastic; many worm casts and holes; neutral; abrupt smooth boundary.

A12—5 to 10 inches; black (2.5Y 2/2) silty clay; weak medium angular blocky structure; very firm, plastic; neutral; clear smooth boundary.

B21—10 to 20 inches; very dark grayish brown (2.5Y 3/2) heavy silty clay; weak medium prismatic structure parting to moderate medium angular blocky; very firm; patchy dark gray (5Y 3/1) clay films and pres-

sure faces; few vesicles and worm casts; mildly alkaline; clear smooth boundary.

B22—20 to 31 inches; dark gray (N 4/0) silty clay; few fine distinct dark yellowish brown (10YR 4/4) mottles; weak medium prismatic structure parting to moderate medium angular blocky; very firm; thin patchy dark gray (5Y 3/1) clay films on faces of peds; many vesicles; few worm casts; mildly alkaline; clear smooth boundary.

IIB3—31 to 39 inches; gray (5Y 5/1) clay loam; common medium distinct dark yellowish brown (10YR 4/4) mottles; weak coarse subangular blocky structure; firm; thin patchy very dark grayish brown (2.5Y 3/2) clay films on vertical faces of peds; many vesicles; few worm channels; mildly alkaline; clear smooth boundary.

IIC1—39 to 47 inches; olive gray (5Y 5/2) loamy very fine sand; common medium distinct dark yellowish brown (10YR 4/4) mottles; massive; friable; dark gray (5Y 4/1) clay flows in worm holes; mildly alkaline; clear smooth boundary.

IIC2—47 to 73 inches; light brownish gray (10YR 6/2) fine sand; single grained; loose; moderately alkaline.

The depth to loamy material, or the IIB horizon, ranges from 30 to 40 inches. The B horizon ranges from slightly acid to mildly alkaline. It is silty clay or clay in the upper part and is clay loam or fine sandy loam in the lower part. It has hue of 2.5Y, 5Y, 10YR, or N. Thin strata of loamy material are in the IIC horizon in some pedons.

Cape series

The Cape series consists of poorly drained, very slowly permeable soils formed in clayey and loamy slack water sediments. These soils are mainly on low-lying benches on bottom land. Slope ranges from 0 to 2 percent.

Cape soils commonly are adjacent to Jacob, Karnak, and Piopolis soils on the landscape and are similar to those soils. They are more acid than Karnak soils and contain less clay in the solum than Jacob and Karnak soils. They contain more clay in the solum than Piopolis soils.

Typical pedon of Cape silty clay loam, about 900 feet north and 160 feet east of the southwest corner of sec. 3, T. 12 S., R. 3 W., in a pasture:

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silty clay loam; moderate fine granular structure; friable; medium acid; abrupt smooth boundary.

A12—6 to 12 inches; dark grayish brown (10YR 4/2) silty clay loam; weak fine subangular blocky structure; firm; common fine dark concretions; medium acid; clear smooth boundary.

B1g—12 to 18 inches; gray (N 5/0) heavy silty clay loam; common fine distinct olive brown (2.5Y 4/4) mottles; weak medium subangular blocky structure; firm; common fine dark concretions; strongly acid; clear smooth boundary.

B21g—18 to 23 inches; dark gray (10YR 4/1) silty clay; common medium distinct dark yellowish brown (10YR 4/4) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; very firm; common fine dark concretions; strongly acid; clear smooth boundary.

B22g—23 to 30 inches; grayish brown (2.5Y 5/2) silty clay; common medium prominent strong brown (7.5YR 4/4) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; very firm; dark grayish brown (2.5Y 4/2) clay films or coatings on faces of peds; strongly acid; gradual smooth boundary.

B3g—30 to 47 inches; grayish brown (5Y 5/2) heavy silty clay loam; many medium distinct yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure; very firm; few dark accumulations; very strongly acid; clear wavy boundary.

C1g—47 to 60 inches; grayish brown (2.5Y 5/2) silty clay loam; massive; firm; dark stains in crevices; strongly acid.

The control section ranges from strongly acid to extremely acid. The A horizon ranges from dark gray (10YR 4/1) to grayish brown (2.5Y 5/2). The B horizon has hue of 10YR to 2.5Y or N, value of 4 to 6, and chroma of 0 to 2. It is silty clay, silty clay loam, or clay. The C horizon has strata of silt in some pedons.

Darwin series

The Darwin series consists of poorly drained or very poorly drained, very slowly permeable soils formed in clayey slack water sediments. These soils are on broad flats and in depressions on flood plains. Slope ranges from 0 to 2 percent.

Darwin soils commonly are adjacent to Cairo, Karnak, and Jacob soils on the landscape and are similar to those soils. Cairo soils contain more sand in the upper 40 inches than Darwin soils, and Karnak and Jacob soils lack a mollic epipedon. Also, Jacob soils are more acid than Darwin soils.

Typical pedon of Darwin silty clay, about 550 feet south and 1,100 feet west of the center of sec. 23, T. 12 S., R. 3 W., in a meadow:

Ap—0 to 4 inches; very dark gray (10YR 3/1) silty clay; weak fine granular structure; firm; common worm casts and channels; neutral; abrupt smooth boundary.

A12—4 to 10 inches; very dark gray (10YR 3/1) silty clay, very dark grayish brown (10YR 3/2) crushed; weak medium subangular blocky structure; firm;

common worm casts and channels; neutral; clear smooth boundary.

B21g—10 to 25 inches; gray (10YR 5/1) silty clay; common medium faint olive brown (2.5Y 4/4) mottles; moderate fine and medium angular blocky structure; very firm; dark gray (10YR 4/1) coatings on faces of peds; neutral; gradual smooth boundary.

B22g—25 to 38 inches; dark gray (N 4/0) heavy silty clay loam; few fine distinct brown (7.5YR 4/4) and common medium distinct dark reddish brown (5YR 3/4) mottles; moderate medium prismatic structure parting to moderate coarse angular blocky; very firm; mildly alkaline; gradual smooth boundary.

B23g—38 to 62 inches; dark gray (N 4/0) silty clay; common medium distinct dark reddish brown (5YR 3/4) and few medium faint olive brown (2.5Y 4/4) mottles; moderate medium prismatic structure parting to moderate coarse angular blocky in the lower part; very firm; dark gray (10YR 4/1 and 5Y 4/1) clay coatings on faces of most peds; mildly alkaline.

The A and B horizons range from slightly acid to mildly alkaline and the C horizon from neutral to moderately alkaline. The A horizon ranges from 10 to 24 inches in thickness. The solum ranges from 45 to more than 60 inches in thickness. The A and B horizons are silty clay loam, clay, or silty clay. In many pedons a C horizon is within a depth of 60 inches. It is mainly silty clay but in some pedons is silty clay loam.

Darwin silty clay, frequently flooded, is outside the range of the Darwin series because it is finely stratified in the upper part of the profile. This difference, however, does not affect the use or behavior of the soil.

Drury series

The Drury series consists of well drained, moderately permeable soils on foot slopes and terraces below the bluffs adjacent to bottom land along the Mississippi River. These soils formed in local silty sediments from loess-covered hills. Slope ranges from 3 to 10 percent.

Drury soils are similar to Haymond soils. They contain more clay in the upper 40 inches than those soils.

Typical pedon of Drury silt loam, 3 to 10 percent slopes, about 1,995 feet north and 85 feet west of the center of sec. 32, T. 12 S., R. 2 W., in a wooded field:

A11—0 to 2 inches; dark brown (10YR 3/3) silt loam; moderate fine granular structure; very friable; medium acid; clear smooth boundary.

A12—2 to 6 inches; dark brown (10YR 3/3) silt loam; weak medium granular structure; friable; very dark grayish brown (10YR 3/2) faces of peds; medium acid; clear smooth boundary.

B21—6 to 15 inches; dark brown (10YR 4/3) silt loam; weak fine subangular blocky structure; friable; very dark grayish brown (10YR 3/2) faces of peds; common vesicles; medium acid; gradual smooth boundary.

B22—15 to 25 inches; dark yellowish brown (10YR 4/4) silt loam; weak fine and medium subangular blocky structure; very friable; dark brown (10YR 3/3) coatings on faces of some peds; common vesicles; medium acid; gradual smooth boundary.

B3—25 to 33 inches; dark yellowish brown (10YR 4/4) silt loam; weak medium subangular blocky structure; friable; pale brown (10YR 6/3) uncoated silt grains on faces of many peds; few vesicles; slightly acid; gradual smooth boundary.

C1—33 to 49 inches; dark yellowish brown (10YR 4/4) and pale brown (10YR 6/3) silt loam; massive; friable; slightly acid; gradual smooth boundary.

C2—49 to 68 inches; light brownish gray (10YR 6/2) silt loam; few fine distinct dark yellowish brown (10YR 4/4) and common fine faint brown (10YR 5/3) mottles; massive; friable; slightly acid.

The solum ranges from 30 to 40 inches in thickness. In some pedons the A horizon has color value of 4. In some, mottles with chroma of 2 are in the lower part of the B horizon. In some pedons strata of coarser textured material are below a depth of 40 inches.

Dupo series

The Dupo series consists of somewhat poorly drained soils that are moderately slowly permeable in the upper part and slowly permeable in the lower part. These soils are on flood plains. They formed in silty and clayey sediments. Slope ranges from 0 to 2 percent.

Dupo soils commonly are adjacent to Wakeland, Medway, and Darwin soils on the landscape. They contain more clay in the lower part of the solum than Wakeland and Medway soils. They contain more silt in the upper part of the solum than Darwin soils.

Typical pedon of Dupo silt loam, about 1,730 feet south and 990 feet west of the northeast corner of sec. 30, T. 12 S., R. 2 W., in a cultivated field:

Ap—0 to 10 inches; dark brown (10YR 4/3) silt loam; moderate fine granular structure; very friable; medium acid; abrupt smooth boundary.

C—10 to 24 inches; dark brown (10YR 4/3) silt loam; common medium faint dark brown (10YR 3/3), grayish brown (10YR 5/2), and dark yellowish brown (10YR 4/4) mottles; massive; friable; common vesicles; slightly acid; clear smooth boundary.

IIA1b—24 to 32 inches; very dark gray (10YR 3/1) heavy silty clay loam; weak fine prismatic structure parting to moderate medium angular blocky; firm; dark grayish brown (10YR 4/2) coatings on faces of peds; few small pores; slightly acid; clear smooth boundary.

IIB21b—32 to 42 inches; dark brown (10YR 4/3) silty clay; common medium distinct yellowish brown (10YR 5/6) mottles; moderate fine angular blocky structure; very firm; dark grayish brown (10YR 4/2) coatings on faces of peds; few fine dark concretions; medium acid; clear smooth boundary.

IIB22b—42 to 55 inches; grayish brown (10YR 5/2) heavy silty clay loam; common medium distinct yellowish brown (10YR 5/8) mottles; moderate medium prismatic structure parting to moderate coarse angular blocky; dark gray (10YR 4/1) coatings on faces of peds; few fine dark concretions; very strongly acid; clear smooth boundary.

IIB3b—55 to 65 inches; grayish brown (10YR 5/2) heavy silty clay loam; common medium faint olive brown (2.5Y 4/4) and distinct yellowish brown (10YR 5/6) mottles; moderate coarse prismatic structure parting to moderate coarse angular blocky; continuous gray (10YR 5/1) coatings on faces of peds; very strongly acid.

Depth to the IIAb horizon ranges from 20 to 40 inches. The 10- to 40-inch control section is medium acid to mildly alkaline. The IIAb and IIBb horizons range from heavy silty clay loam to clay.

Elsah series

The Elsah series consists of well drained and somewhat excessively drained soils that are moderately permeable in the upper part and moderately rapidly permeable in the lower part. These soils formed in silty and cherty stream sediments. They are on narrow bottom land and along some stream channels on the broader bottom land. Slope ranges from 1 to 5 percent.

Elsah soils are on the same flood plains as Haymond and Wakeland soils. They contain more cherty coarse fragments within a depth of 40 inches than those soils.

Typical pedon of Elsah silt loam, about 325 feet north and 335 feet west of the center of sec. 13, T. 11 S., R. 3 W., in a black walnut plantation:

A1—0 to 15 inches; dark brown (10YR 4/3) silt loam; common medium faint brown (10YR 5/3) mottles in the lower part; weak fine and medium granular structure; very friable; common grass roots; 2 percent coarse fragments; medium acid; clear smooth boundary.

IIC1—15 to 17 inches; dark yellowish brown (10YR 4/4) cherty loam; massive; friable; 35 percent coarse fragments; common grass roots; common vesicles; medium acid; clear smooth boundary.

IIC2—17 to 22 inches; strong brown (7.5YR 5/6) very cherty sand; single grained; loose; 70 percent coarse fragments; common grass roots; medium acid; clear smooth boundary.

IIC3—22 to 40 inches; light yellowish brown (10YR 6/4) very cherty loam; single grained; loose; 80 percent coarse fragments; common grass roots to a depth of 30 inches; medium acid; gradual wavy boundary.

IIC4—40 to 60 inches; brown (10YR 5/3) very cobbly loam; massive; friable; 85 percent coarse fragments as much as 6 inches in diameter; medium acid.

Depth to the cherty IIC horizon ranges from 10 to 25 inches, and depth to bedrock is generally 40 to 80 inches. The 10- to 40-inch control section ranges from medium acid to neutral.

The A horizon ranges from very dark grayish brown (10YR 3/2) to yellowish brown (10YR 5/4). The content of coarse fragments ranges from 0 to 15 percent in the A horizon and from 60 to 90 percent in the lower part of the C horizon. It increases with increasing depth.

Gorham series

The Gorham series consists of poorly drained soils that are moderately slowly permeable in the upper part and moderately rapidly permeable in the lower part. Those soils formed in silty and loamy sediments. They are mainly in nearly level areas and on low, undulating ridges on flood plains. Slope ranges from 0 to 3 percent.

Gorham soils are on the same flood plains as Cairo, Darwin, Medway, and Ware soils. They contain less clay than Cairo and Darwin soils and more clay than Medway and Ware soils. Also, they are not so well drained as Medway and Ware soils.

Typical pedon of Gorham silty clay loam, about 1,920 feet north and 1,540 feet east of the southwest corner of sec. 5, T. 12 S., R. 3 W.

Ap—0 to 11 inches; very dark grayish brown (10YR 3/2) silty clay loam; moderate fine subangular blocky structure; firm; very dark gray (10YR 3/1) organic films on faces of peds; many worm casts and holes; mildly alkaline; abrupt wavy boundary.

B21—11 to 19 inches; very dark grayish brown (10YR 3/2) heavy silty clay loam; common fine distinct dark brown (7.5YR 4/4) mottles; weak medium prismatic structure parting to moderate fine angular blocky; firm; continuous very dark gray (10YR 3/1) coatings on vertical faces of peds, patchy on horizontal faces of peds; common worm holes and casts; mildly alkaline; clear smooth boundary.

B22—19 to 26 inches; dark grayish brown (2.5Y 4/2) silty clay loam; common medium distinct dark brown (7.5YR 4/2) and few fine prominent strong brown (7.5YR 5/6) mottles; weak medium prismatic structure parting to moderate fine subangular blocky; firm; very dark gray (10YR 3/1) coatings on vertical faces of peds; few worm holes; neutral; gradual smooth boundary.

B23—26 to 39 inches; dark grayish brown (10YR 4/2) silty clay loam; common medium faint dark brown (10YR 3/3 and 7.5YR 4/2) mottles; moderate coarse and medium subangular blocky structure; friable; patchy dark gray (10YR 4/1) coatings on faces of peds; 20 percent very fine sand; neutral; clear smooth boundary.

IIB3—39 to 43 inches; dark grayish brown (10YR 4/2) clay loam; few fine faint dark brown (7.5YR 4/4) and dark gray (10YR 4/1) mottles; weak coarse subangular blocky structure; friable; gray (10YR 5/1) coatings on vertical faces of peds; neutral; clear smooth boundary.

IIC1—43 to 47 inches; dark brown (10YR 4/3) fine sandy loam; many coarse distinct grayish brown (10YR 5/2) and few medium faint dark brown (7.5YR 4/4) mottles; massive; very friable; neutral; clear smooth boundary.

IIC2—47 to 52 inches; dark brown (10YR 4/3) loamy fine sand; many coarse faint grayish brown (10YR 5/2) mottles; massive; very friable; neutral; clear irregular boundary.

IIC3—52 to 60 inches; light brownish gray (10YR 6/2) fine sand; common fine faint brown (10YR 5/3) mottles; massive; very friable; neutral.

Depth to the IIB3 horizon ranges from 30 to 40 inches. The B horizon ranges from slightly acid to mildly alkaline. The mollic epipedon is 10 to 20 inches thick. The IIB3 horizon ranges from clay loam to fine sandy loam and the IIC horizon from fine sandy loam to fine sand.

Goss series

The Goss series consists of well drained soils that are moderately rapidly permeable in the upper part and moderately permeable in the lower part. These soils formed in residuum weathered from cherty limestone. They are on steep and very steep, dissected hills that parallel the bottom land along the Mississippi River.

In this survey area Goss soils are mapped with Alford soils. They are similar to Baxter soils. Alford soils contain no coarse fragments and contain less clay in the B2t horizon than Goss soils. Baxter soils contain less chert than Goss soils and have a lower base saturation in the B2t horizon.

Typical pedon of Goss very cherty silt loam, in an area of Goss-Alford complex, 30 to 70 percent slopes, about 10 feet north and 2,540 feet west of the center of sec. 22, T. 11 S., R. 3 W.

O1—2 to 0 inches; partly decomposed litter of leaves and twigs.

A1—0 to 3 inches; very dark grayish brown (10YR 3/2) very cherty silt loam; strong fine granular structure; very friable; common worm casts and holes; many tree roots; 60 percent coarse fragments; neutral; clear smooth boundary.

A2—3 to 6 inches; brown (10YR 5/3) very cherty silt loam; moderate fine granular structure; very friable; dark brown (10YR 4/3) faces of peds; many tree roots; 65 percent coarse fragments; common worm casts and holes; neutral; clear smooth boundary.

B1—6 to 10 inches; strong brown (7.5YR 5/6) very cherty silt loam; moderate fine subangular blocky structure; friable; dark yellowish brown (10YR 4/4) faces of peds; 70 percent coarse fragments; many tree roots; few worm casts and holes; slightly acid; clear smooth boundary.

B21t—10 to 18 inches; strong brown (7.5YR 5/6) very cherty heavy silty clay loam; moderate fine subangular blocky structure; friable; dark brown (7.5YR 4/2 and 4/4) organic stains on faces of peds; continuous yellowish red (5YR 5/6) clay films on faces of peds and on coarse fragments; common roots; 85 percent coarse fragments; few dark stains on faces of peds and on coarse fragments; slightly acid; clear smooth boundary.

B22t—18 to 27 inches; strong brown (7.5YR 5/6) very cherty heavy silty clay loam; moderate fine angular blocky structure; firm; few channel fillings of yellow (10YR 7/8) silty material; common roots; 75 percent coarse fragments; continuous strong brown (7.5YR 5/6) and reddish brown (5YR 5/4) clay films and few dark stains on faces of peds and coarse fragments; strongly acid; clear smooth boundary.

B23t—27 to 40 inches; strong brown (7.5YR 5/6) cherty silty clay; moderate fine angular blocky structure; very firm; continuous strong brown (7.5YR 5/6) and reddish brown (5YR 5/4) clay films on faces of peds; few roots; 45 percent coarse fragments; few dark stains on faces of peds; medium acid; clear smooth boundary.

B24t—40 to 60 inches; strong brown (7.5YR 5/6) cherty heavy silty clay loam; moderate fine angular blocky structure; very firm; continuous strong brown (7.5YR 5/6) and yellowish red (5YR 5/6) clay films on faces of peds; few roots; 45 percent coarse fragments; common dark stains on faces of peds; medium acid.

The solum is typically more than 60 inches thick; it ranges from 55 inches to more than 6 feet in thickness. The A1 and A2 horizons are silt loam, cherty silt loam, or very cherty silt loam. The A1 horizon is generally less than 6 inches thick. The B horizon ranges from strongly acid to neutral. The B2t horizon ranges from heavy silty clay loam to clay and from about 45 to 85 percent coarse fragments.

Haymond series

The Haymond series consists of well drained, moderately permeable soils that formed in silty alluvium. They

are on flood plains and alluvial fans along streams. Slope ranges from 0 to 3 percent.

Haymond soils are on the same flood plains as Wakeland and Elsah soils and are similar to Drury soils. Wakeland soils are somewhat poorly drained. Elsah soils contain more coarse fragments in the control section than Haymond soils. Drury soils contain more clay in the solum than Haymond soils.

Typical pedon of Haymond silt loam, about 1,650 feet south and 530 feet east of the northwest corner of sec. 21, T. 12 S., R. 2 W.

Ap—0 to 10 inches; dark brown (10YR 4/3) silt loam; weak medium granular structure; friable; slightly acid; gradual smooth boundary.

A12—10 to 20 inches; brown (10YR 4/3) silt loam; weak medium granular structure; very friable; medium acid; gradual smooth boundary.

C1—20 to 42 inches; yellowish brown (10YR 5/4) silt loam; weak medium subangular blocky structure; friable; medium acid; gradual smooth boundary.

C2—42 to 62 inches; yellowish brown (10YR 5/4) silt loam with pockets of pale brown (10YR 6/3); massive; friable; medium acid.

The control section ranges from medium acid to neutral. The A horizon is dark brown (10YR 4/3), very dark grayish brown (10YR 4/2), or dark yellowish brown (10YR 3/4). Few to common grayish mottles are below a depth of 30 inches in many pedons. Loamy strata, many of which contain some pebbles or flagstones, are below a depth of 40 inches in some pedons.

Hosmer series

The Hosmer series consists of moderately well drained soils that are moderately permeable in the upper part and slowly permeable in the lower part. These soils formed in loess. They are on ridgetops, side slopes, and foot slopes in the uplands. Slope ranges from 2 to 30 percent.

Hosmer soils are commonly adjacent to Alford soils on the landscape and are similar to Zanesville soils. Alford soils do not have a Bx horizon, and Zanesville soils contain coarse fragments in the lower part of the Bx horizon.

Typical pedon of Hosmer silt loam, 2 to 6 percent slopes, about 1,200 feet north and 400 feet west of the southeast corner of SW1/4 sec. 16, T. 11 S., R. 1 E.

Ap—0 to 7 inches; dark brown (10YR 4/3) silt loam; moderate thin platy structure parting to weak fine granular; few weak very fine subangular blocky peds; friable; common krotovinas; many roots; neutral; abrupt smooth boundary.

B21t—7 to 18 inches; brown (10YR 5/3) light silty clay loam; moderate fine and medium subangular blocky structure; firm; discontinuous dark yellowish brown (10YR 4/4) clay films on faces of peds; few krotovinas; common vesicles; common fine dark concretions; strongly acid; gradual smooth boundary.

B22t—18 to 25 inches; yellowish brown (10YR 5/4) heavy silt loam; few medium faint strong brown (7.5YR 5/8) and few fine distinct light brownish gray (10YR 6/2) mottles; moderate fine and medium subangular blocky structure; firm; thin patchy clay films on faces of peds; few fine dark accumulations; strongly acid; abrupt smooth boundary.

B&A—25 to 28 inches; yellowish brown (10YR 5/6) silt loam (B2); fine and medium moderate subangular blocky; firm; thin to thick (25 to 100 centimeters) coatings and cappings of light brownish gray (10YR 6/2) silt (A2); patchy thin dark yellowish brown (10YR 4/4) clay films on faces of peds; common fine dark concretions; strongly acid; abrupt smooth boundary.

Bx1—28 to 35 inches; mottled yellowish brown (10YR 5/6), dark yellowish brown (10YR 4/4), and light brownish gray (2.5Y 6/2) silty clay loam; moderate medium prismatic structure; very firm and brittle; grayish brown (2.5Y 5/2) clay films continuous in both directions on faces of peds; continuous light brownish gray (2.5Y 6/2) uncoated silt grains on faces of peds in the upper part, discontinuous in the lower part; common dark stains and accumulations; strongly acid; gradual smooth boundary.

Bx2—35 to 55 inches; mottled yellowish brown (10YR 5/6), dark yellowish brown (10YR 4/4), and light brownish gray (2.5Y 6/2) light silty clay loam; weak coarse and medium prismatic structure; very firm and brittle; grayish brown (2.5Y 5/2) and brown (10YR 5/3) clay films continuous on vertical faces of peds and patchy on horizontal faces of peds; few dark stains; strongly acid; gradual smooth boundary.

Bx3—55 to 67 inches; yellowish brown (10YR 5/4) silt loam; many coarse prominent light brownish gray (2.5Y 6/2) mottles; weak very coarse prismatic structure; very firm and brittle; patchy grayish brown (2.5Y 5/2) clay films and common dark stains on vertical faces of peds; medium acid; gradual smooth boundary.

Cx—67 to 73 inches; yellowish brown (10YR 5/4) silt loam; common medium prominent light olive gray (5Y 6/2) mottles; massive; firm and brittle; dark stains in some vertical cracks and in old root channels; medium acid.

In slightly eroded areas, the thickness of the solum ranges from 48 to 72 inches and depth to the Bx horizon from 25 to 36 inches. The control section is strongly acid or very strongly acid. The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. Some pedons have an A2 horizon of silt loam. This horizon has hue of 10YR, value of 4 or 5, and chroma of 4 to 6. The B2t

horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 to 6. The Bx horizon has similar colors, but mottles having chroma of 2 or less are evident in most pedons.

Jacob series

The Jacob series consists of very poorly drained and poorly drained, very slowly permeable soils formed in clayey slack water sediments. These soils are on broad flats and low-lying benches and depressions on bottom land along the Mississippi River. Slope ranges from 0 to 2 percent.

Jacob soils are commonly adjacent to Karnak, Darwin, and Piopolis soils on the landscape and are similar to those soils. They are more acid than Karnak and Darwin soils and contain more clay in the solum than Piopolis soils. Unlike Darwin soils, they do not have a mollic epipedon.

Typical pedon of Jacob silty clay, about 700 feet south and 100 feet west of the center of sec. 33, T. 11 S., R. 3 W., in a field of forbs and grasses:

Ap—0 to 9 inches; grayish brown (2.5Y 5/2) silty clay; few fine faint light olive brown (2.5Y 5/4) mottles; weak medium angular blocky and moderate fine granular structure; firm; olive gray (5Y 5/2) faces of peds; common fine dark concretions; very strongly acid; abrupt smooth boundary.

B21g—9 to 18 inches; grayish brown (2.5Y 5/2) clay; common fine distinct yellowish brown (10YR 5/4 and 5/6) mottles; weak medium prismatic structure parting to weak medium angular blocky; very firm; olive gray (5Y 5/2) faces of peds; few fine dark concretions and stains; extremely acid; gradual smooth boundary.

B22g—18 to 39 inches; olive gray (5Y 5/2) clay; common fine distinct yellowish brown (10YR 5/6) mottles; weak medium prismatic structure; very firm, very plastic; common fine dark concretions; very strongly acid; gradual smooth boundary.

B3g—39 to 56 inches; gray (5Y 5/1) clay; common medium distinct olive brown (2.5Y 4/4) mottles; weak medium angular blocky structure; very firm, plastic; common dark stains and rounded accumulations of iron and manganese oxide; very strongly acid; clear smooth boundary.

Cg—56 to 60 inches; olive gray (5Y 5/2) silty clay; common medium distinct olive brown (2.5Y 4/4) and light olive brown (2.5Y 5/6) mottles; massive; firm; dark gray (5Y 4/1) faces along cleavage planes; strongly acid.

The control section ranges from strongly acid to extremely acid and generally from about 60 to 70 percent clay. The A horizon has hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 1 or 2. The B horizon has hue of 10YR to 5Y, value of 5 to 7, and chroma of 1 or 2.

Karnak series

The Karnak series consists of very poorly and poorly drained, very slowly permeable soils formed in clayey sediments. These soils are on broad flats and in narrow depressions on flood plains. Slope ranges from 0 to 2 percent.

Karnak soils are similar to Jacob, Cairo, and Darwin soils. Jacob soils are more acid than Karnak soils. Cairo soils contain more sand within a depth of 40 inches than Karnak soils. Darwin soils have a mollic epipedon.

Typical pedon of Karnak silty clay, about 415 feet south and 1,600 feet west of the northeast corner of sec. 5, T. 12 S., R. 3 W., in a pasture:

Ap—0 to 6 inches; very dark gray (10YR 3/1) heavy silty clay; common fine prominent brownish yellow (10YR 6/6) and strong brown (7.5YR 5/6) mottles around root channels; moderate fine granular structure; very firm, plastic; medium acid; abrupt smooth boundary.

B1g—6 to 13 inches; dark gray (10YR 4/1) clay; common medium prominent strong brown (7.5YR 5/8) and common medium distinct dark brown (7.5YR 4/4) mottles; moderate medium angular blocky structure; very firm, plastic; very dark gray (10YR 3/1) coatings on faces of some peds; strongly acid; clear smooth boundary.

B21g—13 to 25 inches; dark gray (5Y 4/1) clay; common medium prominent dark brown (7.5YR 3/2) mottles; weak medium angular blocky structure; very firm, very plastic; very dark gray (5Y 3/1) coatings on faces of some peds; common dark stains and concretions; medium acid; clear wavy boundary.

B22g—25 to 33 inches; gray (5Y 5/1) silty clay; common fine distinct dark yellowish brown (10YR 4/4) mottles; weak medium angular blocky structure; very firm, very plastic; many fine dark concretions and stains; few slickensides; medium acid; gradual smooth boundary.

B3g—33 to 58 inches; gray (5Y 6/1) silty clay; few fine distinct light olive brown (2.5Y 5/6) and common fine prominent dark yellowish brown (10YR 4/4) mottles; weak medium angular blocky structure; very firm, very plastic; gray (5Y 5/1) coatings on faces of some peds; common dark concretions and stains; common slickensides; medium acid; clear smooth boundary.

Cg—58 to 75 inches; gray (5Y 6/1) silty clay; common medium prominent dark yellowish brown (10YR 4/4) mottles; massive; very firm, plastic; few slickensides; medium acid.

The solum ranges from about 45 to 60 inches in thickness. It is medium acid or strongly acid unless liming has reduced the acidity of the surface layer.

The Ap or A1 horizon has hue of 10YR, value of 3 to 5, and chroma of 1 or 2. It generally has value of 3 if it is less than 10 inches thick. The B horizon has hue of 10YR to 5Y, value of 4 to 7, and chroma of 1 or 2. The C horizon has strata of silty clay loam in some pedons.

Medway series

The Medway series consists of moderately well drained, moderately permeable soils formed in silty and loamy sediments. These soils are on low ridges and natural levees along sloughs or overflow channels on flood plains. Slope ranges from 1 to 6 percent.

Medway soils are commonly adjacent to Ware, Cairo, Bowdre, and Gorham soils on the landscape and are similar to those soils. They contain less clay in the upper part of the B horizon than Bowdre and Cairo soils. They are better drained than Gorham soils, and they contain more clay in the control section than Ware soils.

Typical pedon of Medway silty clay loam, about 740 feet south and 320 feet west of the northeast corner of sec. 8, T. 12 S., R. 3 W., in a cultivated field:

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) silty clay loam; weak coarse subangular blocky and weak thin platy structure; firm; common roots; neutral; abrupt smooth boundary.

B21t—9 to 19 inches; very dark grayish brown (10YR 3/2) silty clay loam; few fine faint dark yellowish brown (10YR 4/4) mottles; moderate medium subangular blocky structure; firm; patchy very dark gray (10YR 3/1) clay films on faces of peds; mildly alkaline; clear smooth boundary.

B22t—19 to 25 inches; dark grayish brown (10YR 4/2) clay loam; few fine faint dark yellowish brown (10YR 4/4) mottles; weak medium subangular blocky structure; firm; continuous very dark grayish brown (10YR 3/2) clay films on faces of peds; mildly alkaline; clear smooth boundary.

IIB23—25 to 28 inches; dark brown (10YR 4/3) loam; weak coarse subangular blocky structure; friable; few krotovinas; patchy very dark grayish brown (10YR 3/2) clay films on faces of peds; mildly alkaline; gradual smooth boundary.

IIB3—28 to 36 inches; dark brown (10YR 4/3) very fine sandy loam; weak coarse subangular blocky structure; friable; patchy very dark grayish brown (10YR 3/2) clay films on faces of peds; few krotovinas; mildly alkaline; clear smooth boundary.

IIC1—36 to 45 inches; brown (10YR 5/3) loamy very fine sand with bands of dark brown (10YR 4/3); massive; very friable; mildly alkaline; gradual smooth boundary.

IIC2—45 to 60 inches; pale brown (10YR 6/3) loamy fine sand with bands of dark brown (10YR 4/3); massive; very friable; mildly alkaline.

The solum ranges from about 28 to 50 inches in thickness and is slightly acid to mildly alkaline. The mollic epipedon ranges from 10 to 24 inches in thickness.

The B2t horizon is silty clay loam, clay loam, or silt loam. The IIB horizon is clay loam, loam, or very fine sandy loam. The B horizon has hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 2 to 4. The C horizon is generally stratified. It is dominantly fine sandy loam or loamy fine sand, but it can have strata of loam, silt loam, clay loam, or loamy very fine sand.

Medway silty clay loam, frequently flooded, is outside the range of the Medway series because of the stratification in the upper part of the profile. This difference, however, does not alter the use or behavior of the soil.

Neotoma series

The Neotoma series consists of well drained, moderately rapidly permeable soils formed in thin deposits of loess or silty colluvium and residuum weathered from siltstone, sandstone, and shale bedrock (fig. 15). These soils are on hillsides. Slope ranges from 20 to 35 percent.

Neotoma soils are on the same hillsides as Wellston soils. In this survey area they are mapped with those soils. They contain more coarse fragments throughout the solum than the Wellston soils.

Typical pedon of Neotoma stony silt loam, in an area of Wellston-Neotoma complex, 20 to 35 percent slopes, about 1,568 feet south and 20 feet east of the center of sec. 10, T. 11 S., R. 1 E., in a wooded field:

A1—0 to 3 inches; very dark grayish brown (10YR 3/2) and dark grayish brown (10YR 4/2) stony silt loam; moderate fine granular structure; friable; 40 percent rock fragments; slightly acid; clear smooth boundary.

A3—3 to 10 inches; dark brown (10YR 4/3) flaggy silt loam; weak medium granular structure; friable; 40 percent rock fragments; slightly acid; clear smooth boundary.

B21t—10 to 17 inches; yellowish brown (10YR 5/6) flaggy silt loam; weak fine subangular blocky structure; friable; 45 percent rock fragments; strongly acid; thin patchy clay films on faces of peds; strongly acid; gradual smooth boundary.

B22t—17 to 26 inches; strong brown (7.5YR 5/6) flaggy heavy silt loam; weak medium subangular blocky structure; friable; 50 percent rock fragments; thin patchy clay films on faces of peds; very strongly acid; abrupt wavy boundary.

B3—26 to 36 inches; brownish yellow (10YR 6/6), yellow (10YR 7/6), and very pale brown (10YR 7/4) very channery loam; weak medium subangular blocky

structure and massive; friable; 75 percent rock fragments; very strongly acid; abrupt smooth boundary.

C1—36 to 48 inches; brownish yellow (10YR 6/6), yellow (10YR 7/6), and very pale brown (10YR 7/4) very channery loam; massive; friable; 90 percent rock fragments; very strongly acid; abrupt irregular boundary.

R—48 inches; acid sandstone and siltstone with thin bands of shale.

The depth to consolidated bedrock ranges from about 40 to 80 inches. The content of sandstone fragments generally ranges from about 35 to 75 percent in the solum, but in many pedons some part of the solum ranges from 15 to 30 percent sandstone fragments. These fragments range from 1 inch to 20 inches in diameter. The fine earth component of the B2t horizon ranges from sandy loam to silty clay loam. This horizon ranges from medium acid to extremely acid.

Piopolis series

The Piopolis series consists of poorly drained, slowly permeable soils formed in silty clay loam alluvium. These soils are on flood plains along the major streams. Slope ranges from 0 to 2 percent.

Piopolis soils are on the same flood plains as Birds, Jacob, and Karnak soils and are similar to those soils. They are more acid in the control section than Birds soils. They contain less clay in the control section than Jacob and Karnak soils.

Typical pedon of Piopolis silty clay loam, about 1,114 feet north and 855 feet east of the southwest corner of sec. 12, T. 12 S., R. 3 W., in a cultivated field:

Ap—0 to 7 inches; mixed grayish brown (10YR 5/2) and dark brown (10YR 4/3) light silty clay loam; few fine distinct strong brown (7.5YR 5/8) mottles; moderate very fine granular structure; friable; strongly acid; abrupt smooth boundary.

B21—7 to 12 inches; light brownish gray (10YR 6/2) light silty clay loam; common medium prominent dark red (2.5YR 3/6) and common medium distinct strong brown (7.5YR 5/6) mottles; moderate fine subangular blocky structure; friable; few dark stains; very strongly acid; clear smooth boundary.

B22g—12 to 19 inches; light gray (5Y 6/1) light silty clay loam; common fine prominent strong brown (7.5YR 5/8) and few fine prominent yellowish red (5YR 4/6) mottles in root channels and cracks and on faces of peds; weak fine prismatic structure parting to moderate fine subangular blocky; friable; thin patchy gray (5Y 5/1) clay films on faces of peds; many large dark stains and common fine concretions; very strongly acid; clear smooth boundary.

B23g—19 to 30 inches; light olive gray (5Y 6/2) silty clay loam; common medium distinct yellowish brown (10YR 5/6) mottles; weak fine prismatic structure parting to moderate fine subangular blocky; firm; patchy thin olive gray (5Y 5/2) clay films on vertical faces of peds; 5 percent very fine sand; very strongly acid; gradual smooth boundary.

B3g—30 to 45 inches; light olive gray (5Y 6/2) heavy silty clay loam; few medium distinct strong brown (7.5YR 5/6) mottles; weak medium prismatic structure parting to weak fine subangular blocky; very firm; few fine dark stains and thin patchy clay films on vertical faces of peds; 5 percent very fine sand; very strongly acid; clear smooth boundary.

Cg—45 to 60 inches; light olive gray (5Y 6/2) silty clay loam; few fine distinct yellowish brown (10YR 5/6) mottles; massive; firm; 10 percent fine sand grains; few fine dark concretions; medium acid.

The 10- to 40-inch control section is silty clay loam that averages between 27 and 35 percent clay. It is strongly acid or very strongly acid.

The A horizon ranges from about 5 to 15 inches in thickness. It has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 0 to 2. The C horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 0 to 2. Some pedons have strata of loamy material below a depth of 40 inches.

Sarpy series

The Sarpy series consists of excessively drained, rapidly permeable soils formed in sandy sediments. These soils are on ridges and natural levees on flood plains. Slope ranges from 1 to 6 percent.

The Sarpy soils in this survey area are outside the range defined for the Sarpy series because in most pedons they have thin loamy layers in the upper 40 inches. This difference, however, does not significantly affect the use or behavior of the soils.

Sarpy soils are on the same flood plains as Ware soils. They contain less silt and clay in the control section than those soils.

Typical pedon of Sarpy loamy fine sand, about 50 feet south and 665 feet east of the northwest corner of sec. 8, T. 13 S., R. 2 W., in a field of grasses and forbs:

Ap—0 to 6 inches; dark brown (10YR 4/3) loamy fine sand; weak fine granular structure; very friable; neutral; abrupt smooth boundary.

A12—6 to 14 inches; brown (10YR 5/3) loamy very fine sand; very weak medium subangular blocky and weak fine granular structure; very friable; neutral; gradual wavy boundary.

C1—14 to 38 inches; yellowish brown (10YR 5/4) loamy fine sand; massive; loose; neutral; gradual wavy boundary.

C2—38 to 60 inches; pale brown (10YR 6/3) loamy fine sand; massive; loose; slight effervescence; moderately alkaline.

The 10- to 40-inch control section ranges from neutral to moderately alkaline. The A horizon is loamy fine sand, loamy very fine sand, fine sandy loam, or fine sand. It has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. The C horizon is loamy fine sand or fine sand. In some pedons it has thin loamy or silty strata. It has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 3 or 4. Mottles with chroma of 2 or less are below a depth of 40 inches in some pedons.

Stoy series

The Stoy series consists of somewhat poorly drained, slowly permeable soils formed in loess. These soils are on broad ridgetops at the head of drainageways and on foot slopes in the uplands. Slope ranges from 0 to 3 percent.

Stoy soils are commonly adjacent to Alford and Hosmer soils on the landscape. They are more poorly drained than those soils.

Typical pedon of Stoy silt loam, 0 to 3 percent slopes, about 300 feet south and 100 feet east of the center of sec. 3, T. 12 S., R. 1 E., in a hayfield:

Ap—0 to 10 inches; brown (10YR 4/3) and yellowish brown (10YR 5/4) silt loam; few fine faint pale brown (10YR 6/3) mottles; moderate fine granular and moderate medium platy structure; friable; neutral; abrupt smooth boundary.

B1—10 to 15 inches; yellowish brown (10YR 5/4) and pale brown (10YR 6/3) silt loam; few fine distinct light gray (10YR 7/2) mottles; moderate fine subangular blocky structure; many fine dark concretions; medium acid; clear smooth boundary.

B2t—15 to 21 inches; yellowish brown (10YR 5/4) heavy silt loam; common medium distinct light gray (10YR 7/2) mottles; moderate fine subangular blocky structure; firm; thin patchy dark yellowish brown (10YR 4/4) clay films and thin patchy pale brown (10YR 6/3) uncoated silt grains on faces of peds; strongly acid; clear smooth boundary.

B&A—21 to 27 inches; yellowish brown (10YR 5/4) silt loam; common medium distinct light gray (10YR 7/2) mottles; moderate fine and medium subangular blocky structure; firm; thin patchy dark yellowish brown (10YR 4/4) clay films and thick white (10YR 8/1) uncoated silt grains on faces of peds; strongly acid; clear smooth boundary.

Bx1—27 to 32 inches; yellowish brown (10YR 5/6) silt loam; common fine distinct grayish brown (10YR 5/2) and few fine distinct strong brown (7.5YR 5/6) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm and brittle; thin continuous brown (10YR 5/3) clay films and pale brown (10YR 6/3) uncoated silt grains on vertical faces of peds; common fine dark concretions and large stains; strongly acid; clear smooth boundary.

Bx2—32 to 42 inches; yellowish brown (10YR 5/4) and strong brown (7.5YR 5/6) silty clay loam; moderate medium prismatic structure parting to moderate coarse subangular blocky; very firm and brittle; thin patchy dark yellowish brown (10YR 4/4) clay films and patches of pale brown (10YR 6/3) uncoated silt grains on vertical faces of peds; few fine dark concretions; strongly acid; clear smooth boundary.

Bx3—42 to 50 inches; yellowish brown (10YR 5/6) silty clay loam; common medium distinct light brownish gray (10YR 6/2) mottles; moderate medium prismatic structure parting to weak coarse subangular blocky; very firm and brittle; thin patchy dark yellowish brown (10YR 4/4) clay films and patches of pale brown (10YR 6/3) uncoated silt grains on vertical faces of peds; few fine dark concretions; medium acid; gradual smooth boundary.

Cx—50 to 78 inches; brown (7.5YR 4/4) silt loam; common medium distinct light gray (10YR 7/2) mottles; massive; firm and brittle; dark stains in crevices; medium acid.

The thickness of the solum ranges from about 45 to more than 60 inches. Depth to the Bx horizon ranges from 25 to 40 inches.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. Some pedons have an A2 horizon. The B2t and Bx horizons are silt loam or silty clay loam and have hue of 10YR, value of 5 or 6, and chroma of 2 to 6. A few pedons lack the B&A horizon.

Tice series

The Tice series consists of somewhat poorly drained, moderately permeable soils formed in silty and loamy sediments. These soils are in nearly level areas or on broad flats on flood plains. Slope ranges from 0 to 3 percent.

Tice soils are commonly adjacent to Gorham, Medway, and Darwin soils on the landscape. Gorham soils are more poorly drained than Tice soils. Medway soils contain more sand than Tice soils, and Darwin soils contain more clay in the control section.

Typical pedon of Tice silty clay loam, 0 to 3 percent slopes, about 40 feet south and 460 feet west of the center of sec. 10, T. 12 S., R. 3 W., in a cultivated field:

Ap1—0 to 5 inches; very dark grayish brown (10YR 3/2) silty clay loam; moderate fine granular structure; friable; common roots; slightly acid; abrupt smooth boundary.

Ap2—5 to 11 inches; very dark grayish brown (10YR 3/2) silty clay loam; weak coarse subangular blocky structure; firm; compacted traffic pan; common roots; neutral; abrupt smooth boundary.

B1—11 to 14 inches; dark grayish brown (10YR 4/2) silty clay loam; few fine faint dark brown (10YR 4/3) mottles; weak medium subangular blocky structure; firm; patchy very dark grayish brown (10YR 3/2) coatings on faces of peds; few krotovinas; few roots; neutral; clear smooth boundary.

B21t—14 to 23 inches; very dark grayish brown (10YR 3/2) heavy silty clay loam; common medium faint dark grayish brown (10YR 3/2) and few fine faint dark brown (10YR 4/3) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; continuous very dark grayish brown (10YR 3/2) coatings on vertical faces of peds, discontinuous on horizontal faces of peds; few fine dark stains; few roots; common krotovinas; neutral; clear smooth boundary.

B22—23 to 29 inches; dark grayish brown (10YR 4/2) silty clay loam; common medium distinct brown (10YR 5/3) and dark yellowish brown (10YR 4/4) and few fine distinct strong brown (7.5YR 5/6) mottles; weak medium prismatic structure parting to weak medium subangular blocky; firm; patchy very dark grayish brown (10YR 3/2) coatings on faces of peds; few roots; few krotovinas; neutral; gradual smooth boundary.

B23—29 to 37 inches; dark grayish brown (10YR 4/2) silty clay loam; common medium faint brown (10YR 5/3) mottles; weak coarse prismatic structure parting to weak coarse subangular blocky; firm; patchy very dark grayish brown (10YR 3/2) coatings on faces of peds; few roots; few krotovinas; neutral; gradual smooth boundary.

B3—37 to 48 inches; dark grayish brown (10YR 4/2) clay loam; common medium faint dark yellowish brown (10YR 3/4) and few fine distinct strong brown (7.5YR 5/6) mottles; weak coarse prismatic structure; friable; patchy very dark grayish brown (10YR 3/2) coatings on vertical faces of peds; few roots; few krotovinas; neutral; gradual smooth boundary.

C1—48 to 60 inches; dark brown (10YR 4/3) light clay loam; few fine faint grayish brown (10YR 5/2) mottles; massive; friable; few roots; slightly acid.

The solum ranges from about 30 to 60 inches in thickness. The control section averages between 25 and 35 percent clay and is slightly acid to mildly alkaline. The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It ranges from 10 to 24 inches in thickness. The B horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. In some pedons the lower part of the B horizon and the C horizon have loamy strata.

Wakeland series

The Wakeland series consists of somewhat poorly drained, moderately permeable soils formed in silty stream sediments. These soils are along streams and overflow channels and on alluvial fans on bottom land. Slope ranges from 0 to 2 percent.

Wakeland soils are on the same flood plains as Haymond, Elsah, Birds, Burnside, and Banlic soils and are similar to those soils. They are more poorly drained than Haymond, Elsah, and Burnside soils. Also, they contain fewer coarse fragments in the control section than Elsah and Burnside soils. They contain less clay in the control section than Birds soils. They do not have the dense Bx horizon characteristic of Banlic soils.

Typical pedon of Wakeland silt loam, about 1,550 feet north and 1,550 feet east of the southwest corner of fractional sec. 7, T. 12 S., R. 1 E., in a meadow of grasses and legumes:

Ap—0 to 7 inches; dark brown (10YR 4/3) silt loam; few medium faint grayish brown (10YR 5/2) and few fine distinct dark yellowish brown (10YR 4/6) mottles; moderate fine granular structure; friable; few medium distinct pale brown (10YR 6/3) silt coatings on exteriors of peds; many worm casts and holes; neutral; abrupt smooth boundary.

C1—7 to 18 inches; grayish brown (10YR 5/2) silt loam; many medium faint dark brown (10YR 4/3), few fine distinct yellowish brown (10YR 5/6), and common medium faint grayish brown (2.5Y 5/2) mottles; massive (stratified); friable; common krotovinas; common strata 1 millimeter to 2 millimeters thick; neutral; gradual smooth boundary.

C2—18 to 34 inches; grayish brown (10YR 5/2) silt loam; many medium faint dark brown (10YR 4/3) and few fine distinct yellowish brown (10YR 5/6) mottles; massive; friable; common strata 1 millimeter to 2 millimeters thick; common vesicles; neutral; gradual smooth boundary.

C3g—34 to 60 inches; grayish brown (2.5Y 5/2) silt loam; common medium distinct dark brown (10YR 4/3), common medium distinct yellowish brown (10YR 5/4), and few medium distinct yellowish brown (10YR 5/6) mottles; massive; friable; common thin strata; slightly acid; clear smooth boundary.

The control section ranges from medium acid to neutral. The A horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. The C horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 1 to 4. Some pedons have loamy strata below a depth of 40 inches.

Ware series

The Ware series consists of moderately well drained soils that are moderately permeable in the upper part and moderately rapidly permeable in the lower part. These soils formed in loamy and sandy sediments. They are on ridges and natural levees on flood plains. Slope ranges from 1 to 6 percent.

Ware soils are on the same flood plains as Medway, Bowdre, and Sarpy soils. Bowdre and Medway soils contain more clay and Sarpy soils less silt and clay in the control section than Ware soils.

Typical pedon of Ware loam, about 250 feet south and 2,400 feet west of the northeast corner of sec. 16, T. 12 S., R. 3 W., in a cultivated field:

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) loam; moderate medium granular structure; very friable; common roots; slightly acid; abrupt smooth boundary.

B1—9 to 12 inches; dark grayish brown (10YR 4/2) loam; weak medium subangular blocky structure; very friable; very dark grayish brown (10YR 3/2) organic coatings on faces of peds; common roots; slightly acid; clear smooth boundary.

B2—12 to 21 inches; brown (10YR 5/3) fine sandy loam; weak coarse subangular blocky structure; very friable; common grayish brown (10YR 5/2) krotovinas and worm casts; neutral; clear smooth boundary.

C1—21 to 28 inches; pale brown (10YR 6/3) loamy very fine sand; massive; very friable; few krotovinas; few roots; neutral; clear smooth boundary.

C2—28 to 35 inches; brown (10YR 5/3) very fine sandy loam; massive; very friable; few krotovinas; few vesicles; few roots; neutral; clear smooth boundary.

C3—35 to 48 inches; brown (10YR 5/3) loam; common fine faint grayish brown (10YR 5/2) and few fine distinct strong brown (7.5YR 5/6) mottles; massive; very friable; very thin silt loam strata; neutral; clear smooth boundary.

IIC4—48 to 60 inches; brown (10YR 5/3) and pale brown (10YR 6/3) fine sand; single grained; loose; slight effervescence; mildly alkaline.

The solum ranges from about 15 to 30 inches in thickness. The control section averages less than 18 percent clay and ranges from medium acid to moderately alkaline.

The A horizon is dominantly loam, but in some pedons it is silt loam or fine sandy loam. It has hue of 10YR and value and chroma of 2 or 3. The B and C horizons generally have hue of 10YR, value of 4 to 6, and chroma of 3 to 6. The B horizon is dominantly loam or fine sandy loam, but in some pedons it has strata of coarser or finer material. The C horizon is commonly stratified. It is dominantly very fine sandy loam, loam, or loamy very fine sand, but it ranges from silt loam to fine sand.

Ware fine sandy loam, frequently flooded, is outside the range of the Ware series because of the stratification in the upper part of the profile. This difference, however, does not alter the use or behavior of the soil.

Wellston series

The Wellston series consists of well drained, moderately permeable soils formed in loess and in the underlying material weathered mostly from siltstone and sandstone. These soils are on hillsides. Slope ranges from 15 to 35 percent.

In this survey area Wellston soils are mapped with Alford and Neotoma soils. Also, they are on the same hillsides as Zanesville and Westmore soils. Alford soils formed entirely in loess and do not have coarse fragments in the lower part of the B horizon. Neotoma soils have a higher content of coarse fragments in the control section than Wellston soils. Westmore soils contain fewer coarse fragments in the IIBt horizon than Wellston soils. Zanesville soils have a dense Bx horizon.

Typical pedon of Wellston silt loam, in an area of Wellston-Neotoma complex, 20 to 35 percent slopes, about 264 feet south and 495 feet west of the northeast corner of sec. 26, T. 11 S., R. 1 E., in a wooded area:

A1—0 to 2 inches; dark grayish brown (10YR 4/2) silt loam; weak fine granular structure; very friable; strongly acid; clear smooth boundary.

A2—2 to 9 inches; pale brown (10YR 6/3) silt loam; weak fine granular and weak very fine subangular blocky structure; friable; strongly acid; clear smooth boundary.

B1—9 to 11 inches; brownish yellow (10YR 6/6) silt loam; weak medium subangular blocky structure; friable; very strongly acid; clear smooth boundary.

B21t—11 to 18 inches; strong brown (7.5YR 5/6) silt loam; weak medium subangular blocky structure; friable; very strongly acid; gradual smooth boundary.

B22t—18 to 25 inches; strong brown (7.5YR 5/6) heavy silt loam; moderate fine and medium subangular blocky structure; firm; thin patchy reddish yellow (7.5YR 6/6) clay films on faces of peds; very strongly acid; gradual wavy boundary.

B23t—25 to 30 inches; strong brown (7.5YR 5/6) heavy silt loam; moderate fine and medium subangular blocky structure; firm; thin continuous reddish yellow (7.5YR 6/6) clay films on faces of peds; extremely acid; abrupt wavy boundary.

IIB3t—30 to 40 inches; strong brown (7.5YR 5/6) very channery light silty clay loam; moderate medium subangular blocky structure; firm; thin patchy yellowish red (5YR 5/6) clay films on faces of peds; 60 percent rock fragments; extremely acid; abrupt wavy boundary.

IIC1—40 to 60 inches; mixed yellowish brown (10YR 5/6), strong brown (7.5YR 5/6), and very pale brown

(10YR 7/3) very channery loam; massive; friable; 90 percent rock fragments; extremely acid.

The depth to bedrock ranges from about 40 to 72 inches. The solum ranges from 32 to 50 inches in thickness. The control section ranges from strongly acid to extremely acid. In most pedons the content of sandstone and siltstone fragments increases with increasing depth, from 0 percent in the upper part of the B horizon to 65 percent in the IIB horizon. These fragments range from 1 inch to 6 inches in diameter.

The A1 horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. The A2 horizon has hue of 10YR, value of 5 or 6, and chroma of 3 or 4. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6.

Westmore series

The Westmore series consists of well drained soils that are moderately permeable in the upper part and moderately slowly permeable in the lower part. These soils formed in loess or silty colluvium and in the underlying material weathered from bedrock. They are on hillsides. Slope ranges from 15 to 30 percent.

In this survey area Westmore soils are mapped with Zanesville soils. Also, they are on the same hillsides as Alford, Neotoma, and Wellston soils. Alford soils formed entirely in loess. Neotoma and Wellston soils have a higher content of coarse fragments in the control section than Westmore soils. Zanesville soils have a Bx horizon.

Typical pedon of Westmore silt loam, in an area of Zanesville-Westmore silt loams, 15 to 30 percent slopes, about 15 feet south and 2,173 feet west of the northeast corner of sec. 26, T. 11 S., R. 1 E., in a wooded field:

A1—0 to 3 inches; dark grayish brown (10YR 4/2) silt loam; weak fine granular structure; very friable; strongly acid; clear smooth boundary.

A2—3 to 6 inches; yellowish brown (10YR 5/4) silt loam; weak fine granular structure; very friable; 5 percent coarse fragments; strongly acid; clear smooth boundary.

B21t—6 to 20 inches; yellowish brown (10YR 5/6) light silty clay loam; common medium faint pale brown (10YR 6/3) mottles; moderate medium subangular blocky structure; friable; 5 percent coarse fragments; thin patchy brownish yellow (10YR 6/6) clay films on faces of peds; strongly acid; clear smooth boundary.

IIB22t—20 to 25 inches; brown (10YR 5/3) heavy silty clay loam; common fine distinct brownish yellow (10YR 6/8) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; thin continuous light brownish gray (10YR 6/2) clay films on faces of peds; 5 percent coarse fragments; white (10YR 8/1) uncoated silt grains on faces of peds; strongly acid; gradual smooth boundary.

IIB23t—25 to 35 inches; light brownish gray (10YR 6/2) silty clay loam; common fine distinct strong brown (7.5YR 5/6) mottles; weak medium prismatic structure parting to moderate medium angular blocky; very firm; thin continuous light brownish gray (10YR 6/2) clay films on faces of peds; 10 percent coarse fragments; very strongly acid; gradual smooth boundary.

IIB3—35 to 58 inches; gray (10YR 6/1) heavy silty clay loam; many medium distinct strong brown (7.5YR 5/8) mottles; weak coarse subangular blocky structure; very firm; thick patchy gray (10YR 5/1) clay films on vertical faces of peds; 15 percent coarse fragments; mildly alkaline; abrupt wavy boundary.

IIC—58 to 62 inches; mixed brownish yellow (10YR 6/6) and light gray (2.5Y 7/1) silty clay; common medium faint yellowish brown (10YR 5/8) mottles; apparent platy structure from weathered shale; very firm; slight effervescence; moderately alkaline.

The solum ranges from 40 to 60 inches in thickness. The depth to bedrock ranges from 48 to 80 inches. The content of coarse fragments ranges from 5 percent or less in the upper part of the Bt horizon to 25 percent in the lower part. The upper part of the Bt horizon is strongly acid or medium acid, and the lower part ranges from very strongly acid to mildly alkaline. The Bt horizon has hue of 7.5YR to 2.5Y, value of 4 to 6, and chroma of 3 to 6. The IIBt horizon is silty clay loam, silty clay, or clay and ranges from about 35 to 55 percent clay.

Zanesville series

The Zanesville series consists of moderately well drained soils that are moderately permeable in the upper part and moderately slowly permeable in the lower part. These soils formed in loess and in the underlying material weathered from sandstone and siltstone. They are on hillsides. Slope ranges from 15 to 30 percent.

In this survey area Zanesville soils are mapped with Westmore soils. They are similar to Hosmer soils. Westmore soils do not have a Bx horizon. Hosmer soils do not have coarse fragments in the lower part of the Bx horizon.

Typical pedon of Zanesville silt loam, in an area of Zanesville-Westmore silt loams, 15 to 30 percent slopes, about 60 feet north and 2,186 feet west of the southeast corner of sec. 23, T. 11 S., R. 1 E., in a wooded field:

A1—0 to 2 inches; dark grayish brown (10YR 4/2) and very dark grayish brown (10YR 3/2) silt loam; weak fine granular structure; friable; strongly acid; abrupt smooth boundary.

A2—2 to 6 inches; yellowish brown (10YR 5/4) silt loam; weak medium platy structure; friable; common fine

dark stains and concretions; 5 percent coarse fragments; very strongly acid; clear smooth boundary.

B1—6 to 10 inches; yellowish brown (10YR 5/6) silt loam; weak fine and medium subangular blocky structure; friable; 5 percent coarse fragments; common fine dark stains and concretions; very strongly acid; clear smooth boundary.

B21t—10 to 22 inches; strong brown (7.5YR 5/6) heavy silt loam; moderate medium subangular blocky structure; friable; patchy thin strong brown (7.5YR 5/6) clay films on faces of peds; 5 percent coarse fragments; common fine dark stains and concretions; very strongly acid; clear smooth boundary.

B22t—22 to 29 inches; strong brown (7.5YR 5/6) heavy silt loam; weak and moderate medium subangular blocky structure; friable; thin patchy brown (7.5YR 4/4) clay films and pale brown (10YR 6/3) uncoated silt grains on faces of peds; common fine dark stains and concretions; very strongly acid; abrupt smooth boundary.

B&A—29 to 32 inches; yellowish brown (10YR 5/6) and dark yellowish brown (10YR 4/4) silt loam (B2); weak and moderate medium subangular blocky structure; firm; thin to thick coatings and fillings of light brownish gray (10YR 6/2) silt (A2); thin patchy brown (7.5YR 4/4) clay films on faces of peds; few medium distinct strong brown (7.5YR 5/8) mottles in the lower part; very strongly acid; abrupt wavy boundary.

IIBx1—32 to 37 inches; brown (7.5YR 5/4) heavy silt loam; common medium distinct strong brown (7.5YR 5/8) mottles; weak coarse prismatic structure parting to weak coarse subangular blocky; firm and brittle; thin patchy brown (10YR 4/3) clay films and pale brown (10YR 6/3) uncoated silt grains on vertical faces of peds; 15 percent fine sand; common dark stains and concretions; strongly acid; clear wavy boundary.

IIBx2—37 to 53 inches; brown (7.5YR 5/4) and light brownish gray (10YR 6/2) silt loam; few medium distinct strong brown (7.5YR 5/8) mottles; weak very coarse prismatic structure and massive; very firm and brittle; thin patchy reddish brown (5YR 4/4) clay films and pale brown (10YR 6/3) uncoated silt grains on vertical faces of peds; 10 percent stones and boulders by volume; common medium and coarse dark stains; medium acid; clear wavy boundary.

IICx—53 to 65 inches; horizontal bands of brown (7.5YR 4/4) and grayish brown (10YR 5/2) silt loam; massive; firm and brittle; about 25 percent irregularly distributed stones and boulders by volume; patches of light brownish gray (10YR 6/2) uncoated silt grains and coarse dark stains in crevices; neutral.

The depth to bedrock ranges from 40 to 80 inches. The thickness of the solum ranges from 35 to 60 inches and depth to the Bx horizon from 23 to 32 inches.

The A1 horizon has hue of 10YR, value of 3 or 4, and chroma of 1 or 2. The A2 horizon has hue of 10YR, value of 5 or 6, and chroma of 2 to 4. The Bt horizon is strongly acid or very strongly acid. The Bt and Bx horizons have hue of 10YR or 7.5YR, value or 4 to 8, and chroma of 4 to 6. The Bx horizon has few to many mottles. It is silt loam, clay loam, loam, or fine sandy loam. Some pedons do not have a B&A horizon. The content of coarse fragments ranges from 0 to 15 percent in the Bx horizon and from 5 to 50 percent in the C horizon.

Classification of the soils

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965. Readers interested in further details about the system should refer to "Soil taxonomy" (*6*).

The system of classification has six categories. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. In this system the classification is based on the different soil properties that can be observed in the field or those that can be inferred either from other properties that are observable in the field or from the combined data of soil science and other disciplines. The properties selected for the higher categories are the result of soil genesis or of factors that affect soil genesis. In table 18, the soils of the survey area are classified according to the system. Categories of the system are discussed in the following paragraphs.

ORDER. Ten soil orders are recognized as classes in the system. The properties used to differentiate among orders are those that reflect the kind and degree of dominant soil-forming processes that have taken place. Each order is identified by a word ending in *sol*. An example is Alfisol.

SUBORDER. Each order is divided into suborders based primarily on properties that influence soil genesis and are important to plant growth or that are selected to reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Udalf (*Ud*, meaning humid, plus *alf*, from Alfisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of expression of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and a prefix that suggests something about the properties of the soil. An example is Hapludalfs (*Hapl*, meaning simple horizons, plus *udalf*, the suborder of Alfisols that have a udic moisture regime).

SUBGROUP. Each great group may be divided into three subgroups: the central (typic) concept of the great groups, which is not necessarily the most extensive subgroup; the intergrades, or transitional forms to other orders, suborders, or great groups; and the extragrades, which have some properties that are representative of the great groups but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that is thought to typify the great group. An example is Typic Hapludalfs.

FAMILY. Families are established within a subgroup on the basis of similar physical and chemical properties that affect management. Among the properties considered in horizons of major biological activity below plow depth are particle-size distribution, mineral content, temperature regime, thickness of the soil penetrable by roots, consistence, moisture equivalent, soil slope, and permanent cracks. A family name consists of the name of a subgroup and a series of adjectives. The adjectives are the class names for the soil properties used as family differentiae. An example is fine-silty, mixed, mesic Typic Hapludalfs.

SERIES. The series consists of soils that formed in a particular kind of material and have horizons that, except for texture of the surface soil or of the underlying substratum, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineral and chemical composition.

Formation of the soils

The following paragraphs describe the factors of soil formation and their effect on the soils in Union County.

Soil-forming processes act on deposited or accumulated geologic material. They slowly change the material into a soil. The characteristics of the soil at any given point are determined by (1) the physical and mineralogical composition of the parent material; (2) the plant and animal life on and in the soil; (3) the topography, or lay of the land; (4) the climate under which the soil material has accumulated and existed since accumulation; and (5) the length of time that the forces of soil formation have acted on the soil material.

Parent material

Parent material is the unconsolidated mass in which the soil forms. It determines the mineralogical and chemical composition of the soil and to a large extent the rate of the soil-forming processes. The soils in Union County formed in loess, alluvium, and material weathered from bedrock (fig. 16).

Loess, or wind-deposited material, is the most extensive parent material in the county. It blankets many of the other materials. It is the parent material of about two-thirds of the soils in the county. It is thickest, 25 to 30 feet thick, on the bluffs along the Mississippi River and thinnest, about 5 or 6 feet thick, on the ridgetops in the northeastern part of the county. In most areas two layers of loess are evident. The upper layer is Peoria Loess. This loess is yellowish brown silt loam. Alford soils formed in areas where Peoria Loess is thickest. The lower layer is Roxana Loess. This material, which weathered before it was covered by Peoria Loess, generally is distinctly browner, less permeable, and more dense than Peoria Loess. In areas where the Peoria Loess is thinner, the Roxana Loess has a greater influence on the modern soil. Hosmer and Zanesville are examples of soils formed in both of the loess deposits.

Soils on flood plains and bottom land formed in water-laid material or alluvium. In many areas they still receive sediments. They range from sand to clay. Darwin and Jacob are examples of soils formed in clayey alluvial sediments deposited by slack water from the Mississippi River. They are on broad flats and in sloughs and old channels. Haymond and Wakeland soils formed in silty material on flood plains or alluvial fans. Ware and Sarpy soils formed in loamy or sandy alluvial deposits on natural levees along old channels.

Some of the soils in the county formed in material weathered from sandstone, siltstone, shale, limestone, or cherty limestone bedrock. In most areas they are moderately steep to very steep soils on side slopes. Neotoma soils formed mainly in material weathered from siltstone and sandstone, Goss soils mainly in material weathered from cherty limestone, and Baxter soils in material weathered from both limestone and cherty limestone.

Some soils formed in loess and in the underlying material weathered from bedrock. Examples are Zanesville, Westmore, and Wellston soils. Zanesville and Wellston soils formed in loess overlying material weathered mainly from sandstone and siltstone. Westmore soils formed in a silty mantle overlying residuum weathered from shale or a mixture of shale and limestone and, in places, sandstone and siltstone.

Plant and animal life

Living organisms, such as plants, animals, bacteria, and fungi, affect soil formation. Plantlife is generally responsible for the amount of nutrients and organic matter in the soil and the color of the surface layer. Most of the soils in Union County formed under trees. As a result, they have a light colored surface layer. Alford and Hosmer soils are examples. Some soils formed mainly under grass have a dark colored surface layer. These soils contain more organic matter than those formed under trees. The dark colored Medway and Darwin soils on bottom land are examples.

Burrowing animals help to keep the soil open and porous. Bacteria and fungi aid in the decomposition of plant and animal remains.

Topography

Many differences among the soils in the county are the result of differences in topography. Slope, or lay of the land, affects drainage, runoff, erosion, and deposition. Slopes differ in gradient, length, shape, and exposure. Some or all of these slope characteristics are responsible for differences among the soils that formed in similar parent materials, such as Hosmer and Stoy soils. If the topography is similar, soils that formed in different parent materials have similar natural drainage characteristics. Alford and Baxter soils are examples.

As slope increases, the rate of runoff and the extent of erosion increase. Erosion constantly changes characteristics of soils, as is evident in the severely eroded, eroded, and uneroded Alford soils. In nearly level soils, water can move through the parent material and the subsoil has a higher content of clay than that of more sloping soils. Stoy soils are an example.

Climate

Climate influences the variety of plants and largely determines the type of weathering that takes place. The humid, temperate climate of Union County has favored the generally rapid weathering of soil material, the formation of clay, and the downward movement of this material in the profile. The subsoil in most upland soils in the county contains more clay than the surface layer. Soil temperatures vary somewhat throughout the county. The soils on bottom land along the Mississippi River are slightly warmer than the rest of the soils in the county, and the soils at the higher elevations and on the north-facing slopes are cooler. More detailed information on the climate is available under the heading "General nature of the county."

Time

Time is required for the parent material to be changed into a soil. The change takes place slowly. Maturity of a soil is expressed in terms of the degree of profile development. Soils that formed in parent material of the same age can differ in maturity. Those that show little or no evidence of profile development are immature. Those having well expressed horizons are mature. Both Haymond and Alford soils formed in silty material. Haymond soils are young. These bottom land soils are still accumulating material deposited by floodwater and have only weakly expressed horizons. Alford soils are considered mature because the time since deposition has been long enough for the development of a distinct profile.

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Glossary

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon. Commonly such soil formed in recent alluvium or on steep rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim. An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch

of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	More than 9

Basal till. Compact glacial till deposited beneath the ice.

Base saturation. The degree to which material having base exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the exchange capacity.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bench terrace. A raised, level or nearly level strip of earth constructed on or nearly on a contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

Bottom land. The normal flood plain of a stream, subject to frequent flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Broad-base terrace. A ridge-type terrace built to control erosion by diverting runoff along the contour at a nonscouring velocity. The terrace is 10 to 20 inches high and 15 to 30 feet wide and has gently sloping sides, a rounded crown, and a dish-shaped channel along the upper side. It may be nearly level or have a grade toward one or both ends.

Calcareous soil. A soil containing enough calcium carbonate (commonly with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid. A soil having measurable amounts of calcium carbonate or magnesium carbonate.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Channery soil. A soil, that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a fragment.

Chiseling. Tillage with an implement having one or more soil-penetrating points that loosen the subsoil and bring clods to the surface. A form of emergency tillage to control soil blowing.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coat, clay skin.

Coarse fragments. Mineral or rock particles up to 3 inches (2 millimeters to 7.5 centimeters) in diameter.

Coarse textured (light textured) soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the bases of steep slopes.

Complex, soil. A map unit of two or more kinds of soil occurring in such an intricate pattern that they cannot be shown separately on a soil map at the selected scale of mapping and publication.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation cropping system. A cropping system in which crops are grown under management that not only meets the economic needs of farmers but also improves or maintains the physical condition of the soil, protects the soil against erosion, and controls weeds, insects, and plant diseases.

Conservation tillage. Any tillage system that protects the soil against erosion and maintains or improves tilth and the infiltration rate through the use of tillage implements that do not turn over the soil and through retention of crop residue on the surface during the entire year. Examples are no tillage, strip tillage, and stubble mulching.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping (or contour farming). Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is 40 or 80 inches (1 or 2 meters).

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave. Unstable walls of cuts made by earth-moving equipment. The soil sloughs easily.

Depth to rock. Bedrock at a depth that adversely affects the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients, as for example in "hillpeats" and "climatic moors."

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Erosion. The wearing away of the land surface by running water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes a bare surface.

Erosion pavement. A layer of gravel or stones that remains on the ground surface after fine particles are removed by wind or water. Desert pavements result from wind erosion in arid areas.

Excess fines. Excess silt and clay. The soil does not provide a source of gravel or sand for construction purposes.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Favorable. Favorable soil features for the specified use.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured (heavy textured) soil. Sandy clay, silty clay, and clay.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist, 6 to 15 inches (15 to 37.5 centimeters) long.

Flooding. The temporary covering of soil with water from overflowing streams, runoff from adjacent slopes, and tides. Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; *November-May*, for example, means that flooding can occur during the period November through May. Water standing for short periods after rainfall or commonly covering swamps and marshes is not considered flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forage. Plant material used as feed by domestic animals. Forage can be grazed or cut for hay.

Forb. Any herbaceous plant not a grass or a sedge.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Frost action. Freezing and thawing of soil moisture. Frost action can damage structures and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Gleyed soil. A soil having one or more neutral gray horizons as a result of waterlogging and lack of oxygen. The term "gleyed" also designates gray horizons and horizons having yellow and gray mottles as a result of intermittent waterlogging.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material from 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table, which is the upper limit of saturation.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Habitat. The natural abode of a plant or animal; refers to the kind of environment in which a plant or animal normally lives, as opposed to the range or geographical distribution.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. The major horizons of mineral soil are as follows:

O horizon.—An organic layer, fresh and decaying plant residue, at the surface of a mineral soil.

A horizon.—The mineral horizon, formed or forming at or near the surface, in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon most of which was originally part of a B horizon.

A2 horizon.—A mineral horizon, mainly a residual concentration of sand and silt high in content of resistant minerals as a result of the loss of silicate clay, iron, aluminum, or a combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or a combination of these; (2) by prismatic or blocky structure; (3) by redder or browner colors than those in the A horizon; or (4) by a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that from which the solum is presumed to have formed. If the material is known to differ from that in the solum, the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered, but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Karst (topography). The relief of an area underlain by limestone that dissolves in differing degrees, thus forming numerous depressions or small basins.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Large stones. Rock fragments 10 inches (25 centimeters) or more across. Large stones adversely affect the specified use.

Leaching. The removal of soluble material from soil or other material by percolating water.

Light textured soil. Sand and loamy sand.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. Inadequate strength for supporting loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is greater than that of organic soil.

Miscellaneous areas. Areas that have little or no natural soil, are too nearly inaccessible for orderly examination, or cannot otherwise be feasibly classified.

Moderately coarse textured (moderately light textured) soil. Sandy loam and fine sandy loam.

Moderately fine textured (moderately heavy textured) soil. Clay loam, sandy clay loam, and silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse* more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of the three single variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Narrow-base terrace. A terrace no more than 4 to 8 feet wide at the base. A narrow-base terrace is

similar to a broad-base terrace, except for the width of the ridge and channel.

Neutral soil. A soil having a pH value between 6.6 and 7.3.

Nutrient, plant. Any element taken in by a plant, essential to its growth, and used by it in the production of food and tissue. Plant nutrients are nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, zinc, and perhaps other elements obtained from the soil; and carbon, hydrogen, and oxygen obtained largely from the air and water.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Pan. A compact, dense layer in a soil. A pan impedes the movement of water and the growth of roots. The word "pan" is commonly combined with other words that more explicitly indicate the nature of the layer; for example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan.*

Parent material. The great variety of unconsolidated organic and mineral material in which soil forms. Consolidated bedrock is not yet parent material by this concept.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly. The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves through the soil. Terms describing permeability are *very slow* (less than 0.06 inch), *slow* (0.06 to 0.20 inch), *moderately slow* (0.2 to 0.6 inch), *moderate* (0.6 to 2.0 inches), *moderately rapid* (2.0 to 6.0 inches), *rapid* (6.0 to 20 inches), and *very rapid* (more than 20 inches).

Phase, soil. A subdivision of a soil series or other unit in the soil classification system based on differences in the soil that affect its management. A soil series, for example, may be divided into phases on the basis of differences in slope, stoniness, thickness, or some other characteristic that affects management. These differences are too small to justify separate series.

pH value. (See Reaction, soil). A numerical designation of acidity and alkalinity in soil.

Piping. Moving water forms subsurface tunnels or pipelike cavities in the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from a semisolid to a plastic state.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Productivity (soil). The capability of a soil for producing a specified plant or sequence of plants under a specified system of management. Productivity is measured in terms of output, or harvest, in relation to input.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulates over disintegrating rock.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth. Shallow root zone. The soil is shallow over a layer that greatly restricts roots. See Root zone.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged in stream channels from a drainage area. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedi-

mentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage. The rapid movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils, formed in a particular type of parent material, having horizons that, except for the texture of the A or surface horizon, are similar in all profile characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineralogical and chemical composition.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and runoff water.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Sinkhole. A depression in a landscape where limestone has been locally dissolved.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slick spot. Locally, a small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil is generally silty or clayey, is slippery when wet, and is low in productivity.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Small stones. Rock fragments 3 to 10 inches (7.5 to 25 centimeters) in diameter. Small stones adversely affect the specified use.

Soil. A natural, three-dimensional body at the earth's surface that is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: *very coarse sand* (2.0 millimeters to 1.0 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter); *silt* (0.05 to 0.002 millimeter); and *clay* (less than 0.002 millimeter).

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in mature soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristics of the soil are largely confined to the solum.

Stone line. A concentration of coarse fragments in soils that generally marks an old weathering surface. In a cross section, the line may be one fragment or more thick. The line generally overlies material that weathered in place and marks the top of a paleosol. It is ordinarily overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stratified. Arranged in strata, or layers. The term refers to geologic material. Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil, or partly worked into the soil, to provide protec-

tion from soil blowing and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the A2 horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use or management.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it can soak into the soil or flow slowly to a prepared outlet without harm. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea. A stream terrace is frequently called a second bottom, in contrast with a flood plain, and is seldom subject to overflow. A marine terrace, generally wide, was deposited by the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt, silt loam, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer. Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The condition of the soil, especially the soil structure, as related to the growth of plants. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Topsoil (engineering). Presumably a fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Trace elements. The chemical elements in soils, in only extremely small amounts, essential to plant growth. Examples are zinc, cobalt, manganese, copper, and iron.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water.

Water table, apparent. A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

Water table, artesian. A water table under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole.

Water table, perched. A water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

ILLUSTRATIONS

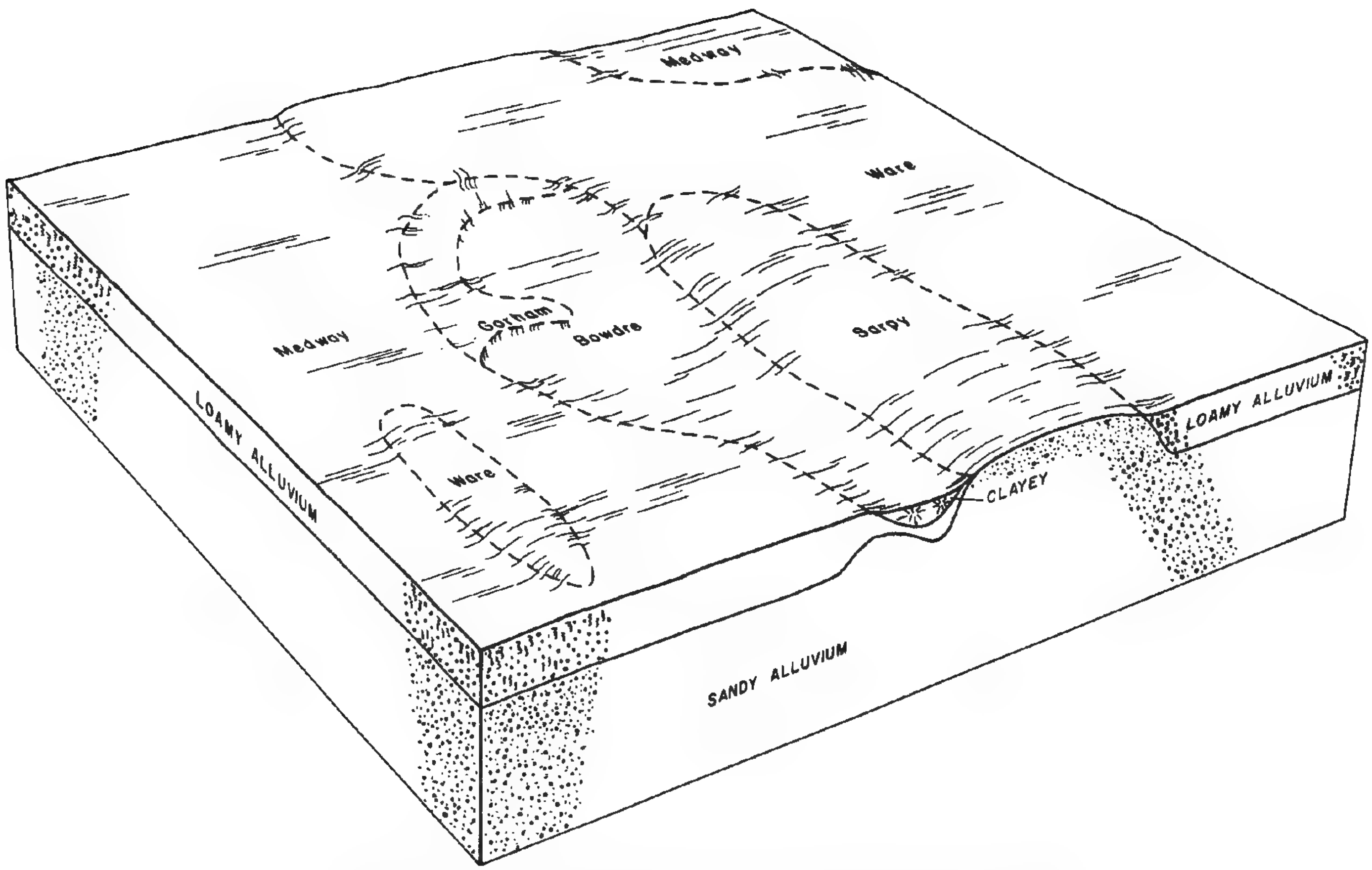

Figure 1.—Pattern of soils and underlying material in the Ware-Medway association.

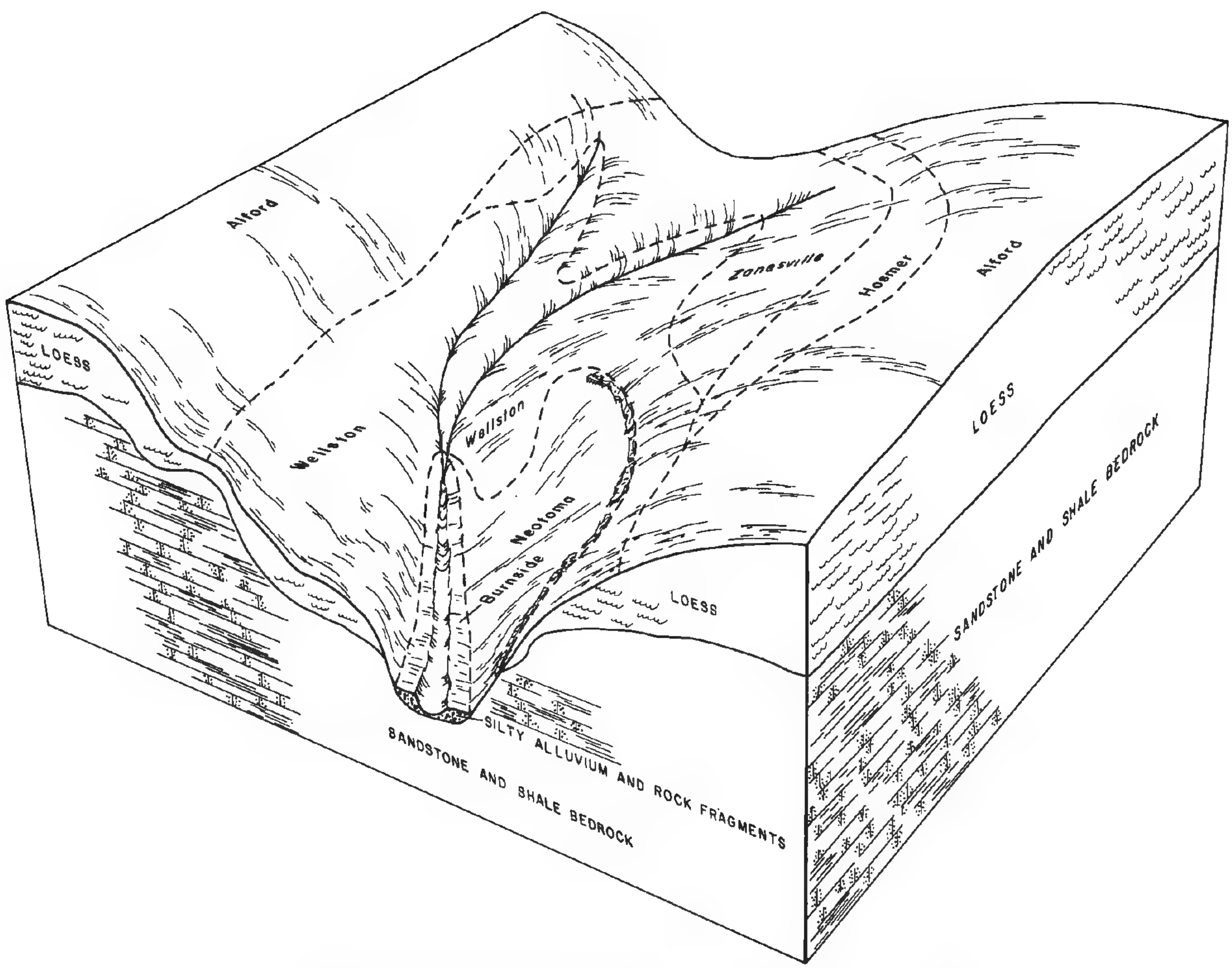

Figure 2.—Pattern of soils and underlying material in the Alford-Wellston association.

Figure 3.—Strawberries planted on the contour on Hosmer silt loam, 2 to 6 percent slopes.

Figure 4.—Dwellings without basements on Hosmer silt loam, 2 to 6 percent slopes. This soil is suitable as a site for such buildings.

Figure 5.—Tomatoes on Alford silt loam, 2 to 6 percent slopes, eroded. This soil is suited to tomatoes.

Figure 6.—Pasture in a formerly cropped area of Alford silty clay loam, 6 to 12 percent slopes, severely eroded.

Figure 7.—High-quality timber in a mature oak-hickory stand on Alford silt loam, 18 to 30 percent slopes.

Figure 8.—A stand of silver maple and cottonwood on Wakeland silt loan.

Figure 9.—An area of Karnak clay, ponded. This soil provides good habitat for wetland wildlife.

Figure 10.—An area of Alford soils, karst, 2 to 20 percent slopes.

Figure 11.—A peach orchard on Hosmer soils. The grass cover reduces the risk of erosion.

Figure 12.—Blueberries on Hosmer soils. Mulch between rows of specialty crops helps to protect the soil against erosion.

Figure 13.—A stony stream in an area of Burnside loam on narrow bottom land.

Figure 14.—Flooding on Birds silt loam. This soil is subject to frequent flooding.

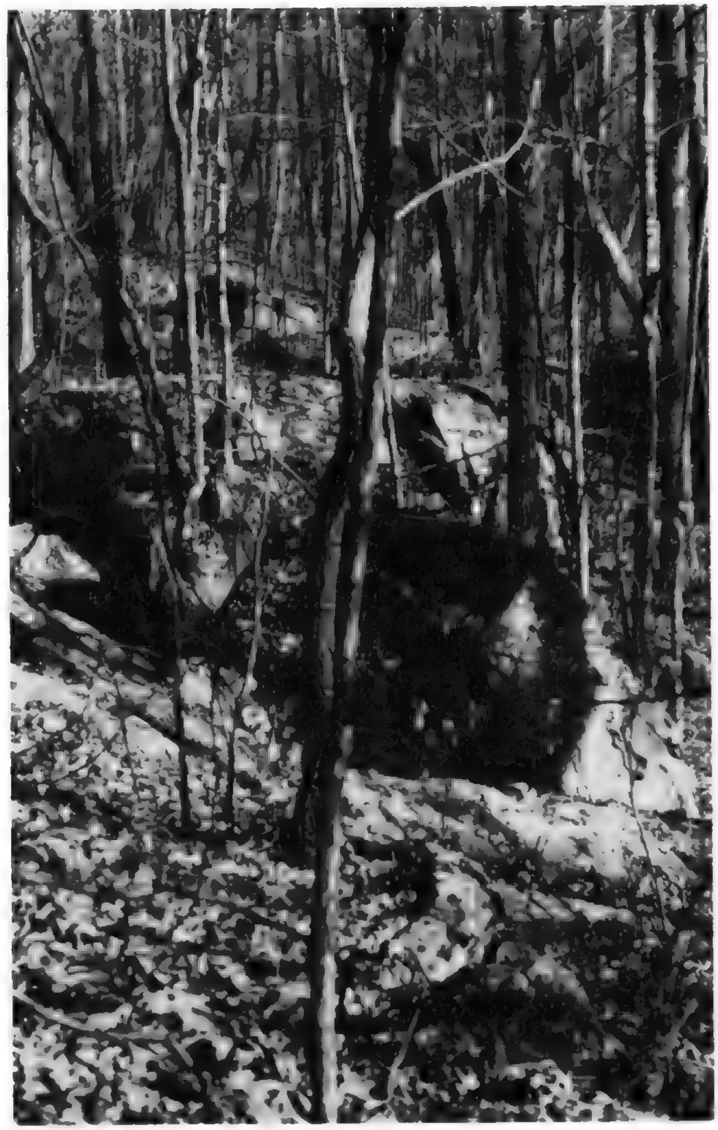

Figure 15.—Boulders from bedrock escarpments on Neotoma soils. Such boulders are common on these soils.

Figure 16.—A massive layer of sandstone. Westmore and Neotoma soils formed in material weathered from interbedded sandstone and shale.

TABLES

TABLE 1.--TEMPERATURE AND PRECIPITATION DATA

Month	Temperature[1]						Precipitation[1]				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days[2]	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	42.5	24.2	33.3	67	-4	35	3.13	1.64	4.35	6	3.8
February---	47.0	27.6	37.3	71	1	82	3.28	1.80	4.48	6	3.4
March------	55.6	35.0	45.3	79	13	247	4.59	2.39	6.38	7	3.0
April------	68.5	46.8	57.7	86	26	531	4.47	2.64	6.09	8	.2
May--------	77.7	55.1	66.4	91	35	818	5.06	2.91	6.81	7	.0
June-------	86.4	63.6	75.0	99	48	1,050	4.11	2.35	5.55	6	.0
July-------	89.0	66.9	78.0	99	52	1,178	4.19	2.04	5.93	6	.0
August-----	88.1	65.2	76.6	99	51	1,135	3.48	2.10	4.71	5	.0
September--	82.2	58.7	70.5	96	41	915	3.36	1.51	4.86	5	.0
October----	71.6	47.5	59.6	89	27	608	2.43	.79	3.73	4	.0
November---	56.6	36.4	46.5	78	13	218	3.83	1.87	5.42	6	.8
December---	45.4	28.4	36.9	69	1	100	3.82	2.01	5.29	7	2.4
Year-----	67.6	46.3	56.9	101	-6	6,917	45.75	38.44	52.74	73	13.6

[1]Recorded in the period 1951-73 at Anna, Ill.

[2]A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40° F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

Probability	Temperature[1]		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	April 7	April 12	April 27
2 years in 10 later than--	April 1	April 8	April 21
5 years in 10 later than--	March 21	March 31	April 11
First freezing temperature in fall:			
1 year in 10 earlier than--	October 25	October 22	October 16
2 years in 10 earlier than--	October 30	October 27	October 19
5 years in 10 earlier than--	November 9	November 5	October 27

[1]Recorded in the period 1951-73 at Anna, Ill.

TABLE 3.--GROWING SEASON LENGTH

Probability	Daily minimum temperature during growing season[1]		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	209	198	182
8 years in 10	217	205	187
5 years in 10	232	218	198
2 years in 10	247	230	209
1 year in 10	255	237	214

[1]Recorded in the period 1951-73 at Anna, Ill.

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
71	Darwin silty clay	3,161	1.2
75C	Drury silt loam, 3 to 10 percent slopes	337	0.1
85	Jacob silty clay	2,826	1.0
92	Sarpy loamy fine sand	301	0.1
162	Gorham silty clay loam	1,106	0.4
164A	Stoy silt loam, 0 to 3 percent slopes	633	0.2
180	Dupo silt loam	973	0.4
214B	Hosmer silt loam, 2 to 6 percent slopes	21,506	7.9
214C2	Hosmer silt loam, 6 to 12 percent slopes, eroded	15,233	5.6
214C3	Hosmer silty clay loam, 6 to 12 percent slopes, severely eroded	9,773	3.6
214D2	Hosmer silt loam, 12 to 18 percent slopes, eroded	7,367	2.7
214D3	Hosmer silty clay loam, 12 to 18 percent slopes, severely eroded	13,939	5.2
214E	Hosmer silt loam, 18 to 30 percent slopes	927	0.3
214E3	Hosmer silty clay loam, 18 to 30 percent slopes, severely eroded	681	0.3
284A	Tice silty clay loam, 0 to 3 percent slopes	1,046	0.4
308B2	Alford silt loam, 2 to 6 percent slopes, eroded	8,860	3.3
308C2	Alford silt loam, 6 to 12 percent slopes, eroded	15,669	5.8
308C3	Alford silty clay loam, 6 to 12 percent slopes, severely eroded	3,463	1.3
308D2	Alford silt loam, 12 to 18 percent slopes, eroded	4,172	1.5
308D3	Alford silty clay loam, 12 to 18 percent slopes, severely eroded	9,015	3.3
308E	Alford silt loam, 18 to 30 percent slopes	6,865	2.5
308E3	Alford silty clay loam, 18 to 30 percent slopes, severely eroded	6,328	2.3
331	Haymond silt loam	7,175	2.6
333	Wakeland silt loam	17,732	6.5
334	Birds silt loam	2,490	0.9
420	Piopolis silty clay loam	1,255	0.5
422	Cape silty clay loam	931	0.3
426	Karnak silty clay	4,331	1.6
427	Burnside loam	827	0.3
456	Ware loam	4,815	1.8
475	Elsah silt loam	4,653	1.8
589	Bowdre silty clay	2,206	0.8
590	Cairo silty clay	3,207	1.2
682	Medway silty clay loam	3,805	1.4
787	Banlic silt loam	433	0.2
801B	Orthents, silty, 1 to 5 percent slopes	281	0.1
802D	Orthents, loamy, 2 to 20 percent slopes	1,598	0.6
852E	Alford-Wellston silt loams, 15 to 30 percent slopes	2,573	0.9
864	Pits, quarry, limestone	706	0.3
930F	Alford-Goss complex, 20 to 35 percent slopes	3,268	1.2
930G	Goss-Alford complex, 30 to 70 percent slopes	37,241	13.7
940E	Zanesville-Westmore silt loams, 15 to 30 percent slopes	14,019	5.2
954E	Alford-Baxter complex, 15 to 30 percent slopes	2,063	0.8
977F	Wellston-Neotoma complex, 20 to 35 percent slopes	3,090	1.1
1334	Birds silt loam, wet	1,177	0.4
1426	Karnak silty clay, wet	1,776	0.7
3071	Darwin silty clay, frequently flooded	814	0.3
3092	Sarpy fine sand, frequently flooded	970	0.4
3456	Ware fine sandy loam, frequently flooded	934	0.3
3590	Cairo silty clay, frequently flooded	878	0.3
3682	Medway silty clay loam, frequently flooded	1,992	0.7
4426	Karnak clay, ponded	484	0.2
5308D	Alford soils, karst, 2 to 20 percent slopes	4,225	1.6
	Water	5,230	1.9
	Total	271,360	100.0

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE

[All yields were estimated for a high level of management. Absence of a yield figure indicates the crop is seldom grown or is not suited]

Soil name and map symbol	Corn	Soybeans	Winter wheat	Grain sorghum	Grass-legume hay	Grass-clover
	Bu	Bu	Bu	Cwt	Ton	AUM*
71-----Darwin	80	38	30	45	3.0	4.5
75C-----Drury	100	33	45	56	4.2	---
85-----Jacob	55	23	24	50	2.0	3.3
92**-----Sarpy	---	---	15	---	0.9	---
162-----Gorham	118	40	47	66	4.5	7.5
164A-----Stoy	97	32	45	55	4.1	7.0
180-----Dupo	112	37	46	63	4.3	7.0
214B-----Hosmer	95	33	43	53	3.1	---
214C2-----Hosmer	85	30	38	48	2.8	---
214C3-----Hosmer	75	26	34	42	2.5	---
214D2-----Hosmer	70	24	32	40	2.3	---
214D3-----Hosmer	---	---	27	---	2.0	---
214E-----Hosmer	---	---	29	---	2.1	---
214E3-----Hosmer	---	---	25	---	1.8	---
284A-----Tice	128	41	52	72	5.1	8.0
308B2-----Alford	110	40	45	62	4.0	---
308C2-----Alford	100	36	42	56	3.6	---
308C3-----Alford	85	32	38	48	3.4	---
308D2-----Alford	85	33	38	48	3.1	---
308D3-----Alford	---	---	---	---	3.0	---
308E-----Alford	---	---	---	---	2.8	---

See footnotes at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Soybeans	Winter wheat	Grain sorghum	Grass-legume hay	Grass-clover
	Bu	Bu	Bu	Cwt	Ton	AUM*
308E3------------------- Alford	---	---	---	---	2.6	---
331--------------------- Haymond	125	34	50	70	4.1	---
333--------------------- Wakeland	135	47	54	76	4.4	---
334--------------------- Birds	115	39	45	64	4.3	---
420--------------------- Piopolis	90	32	40	50	3.8	6.0
422**------------------- Cape	95	32	40	53	3.0	5.8
426--------------------- Karnak	84	29	32	47	2.8	3.5
427--------------------- Burnside	82	29	36	46	3.5	6.0
456--------------------- Ware	98	34	44	55	3.1	6.2
475--------------------- Elsah	85	28	38	48	3.5	4.2
589**------------------- Bowdre	75	35	38	42	4.0	5.0
590--------------------- Cairo	90	30	34	50	3.8	4.8
682--------------------- Medway	130	50	50	73	5.5	---
787--------------------- Banlic	105	38	50	59	4.0	6.8
801B***, 802D***. Orthents						
852E-------------------- Alford-Wellston	---	---	---	---	3.2	---
864***. Pits						
930F-------------------- Alford-Goss	---	---	---	---	---	---
930G-------------------- Goss-Alford	---	---	---	---	---	---
940E-------------------- Zanesville-Westmore	---	---	---	---	---	---
954E-------------------- Alford-Baxter	---	---	---	---	---	---
977F-------------------- Wellston-Neotoma	---	---	---	---	---	---
1334-------------------- Birds	---	---	---	---	---	---

See footnotes at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Soybeans	Winter wheat	Grain sorghum	Grass-legume hay	Grass-clover
	Bu	Bu	Bu	Cwt	Ton	AUM*
1426. Karnak						
3071 Darwin	70	28	---	---	---	---
3092 Sarpy	---	---	15	---	0.9	---
3456 Ware	80	30	---	---	4.1	6.2
3590 Cairo	---	---	---	---	---	2.1
3682 Medway	100	35	---	---	5.5	---
4426 Karnak	---	---	---	---	---	---
5308D Alford	85	33	38	48	3.1	---

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

** Yields are for areas protected from flooding.

*** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 6.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available]

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Trees to plant
71 Darwin	3w	Slight	Severe	Severe	Slight	Pin oak Swamp white oak Eastern cottonwood Green ash American sycamore	80 --- --- --- ---	Eastern cottonwood, American sycamore, red maple, green ash, pin oak.
75C Drury	1o	Slight	Slight	Slight	Slight	Yellow-poplar White oak Northern red oak Sweetgum Green ash	95 85 85 --- ---	Yellow-poplar, white oak, northern red oak, sweetgum, black walnut, eastern white pine, loblolly pine, shortleaf pine.
85 Jacob	3w	Slight	Severe	Severe	Moderate	Pin oak Swamp white oak Eastern cottonwood American sycamore	80 --- --- ---	Eastern cottonwood, pin oak, green ash, American sycamore.
92 Sarpy	5s	Slight	Slight	Severe	Slight	Eastern cottonwood	60	Eastern cottonwood, black willow.
162 Gorham	2w	Slight	Moderate	Moderate	Slight	Pin oak Eastern cottonwood Sweetgum Cherrybark oak American sycamore	90 100 --- --- ---	Eastern cottonwood, red maple, American sycamore, pin oak, sweetgum.
164A Stoy	3o	Slight	Slight	Slight	Slight	White oak Southern red oak White ash Bur oak	70 70 --- ---	Shortleaf pine, loblolly pine, eastern white pine, Scotch pine, eastern redcedar.
180 Dupo	---	--------	--------	--------	--------		---	Black walnut, American sycamore, eastern cottonwood, green ash, yellow-poplar, red maple, cherrybark oak.
214B, 214C2, 214C3 Hosmer	2o	Slight	Slight	Slight	Slight	White oak Yellow-poplar Virginia pine Sugar maple	75 90 75 75	Eastern white pine, shortleaf pine, red pine, yellow-poplar, white ash.
214D2, 214D3, 214E, 214E3 Hosmer	2r	Moderate	Moderate	Slight	Slight	White oak Yellow-poplar Virginia pine Sugar maple	75 90 75 75	Eastern white pine, shortleaf pine, red pine, yellow-poplar, white ash, Virginia pine.
284A Tice	---	--------	--------	--------	--------		---	American sycamore, eastern cottonwood, green ash, yellow-poplar, red maple, cherrybark oak.

TABLE 6.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Trees to plant
308B2, 308C2, 308C3, 308D2, 308D3 Alford	1o	Slight	Slight	Slight	Slight	White oak Yellow-poplar Sweetgum	90 98 76	Eastern white pine, Virginia pine, black walnut, shortleaf pine, yellow-popular, white ash, loblolly pine, black locust.
308E, 308E3 Alford	1r	Moderate	Moderate	Slight	Slight	White oak Yellow-poplar Sweetgum	90 98 76	Eastern white pine, Virginia pine, black walnut, yellow-poplar, white ash, black locust, loblolly pine, shortleaf pine.
331 Haymond	1o	Slight	Slight	Slight	Slight	Yellow-poplar White oak Black walnut	100 90 70	Black walnut, yellow-poplar, black locust.
333 Wakeland	2o	Slight	Slight	Slight	Slight	Pin oak Sweetgum Yellow-poplar Virginia pine	90 85 90 90	Baldcypress, American sycamore, red maple, green ash.
334 Birds	2w	Slight	Severe	Moderate	Slight	Eastern cottonwood Pin oak Sweetgum Cherrybark oak American sycamore	100 90 --- --- ---	Eastern cottonwood, red maple, American sycamore, baldcypress, water tupelo.
420 Piopolis	2w	Slight	Severe	Moderate	Slight	Pin oak Eastern cottonwood Sweetgum Cherrybark oak American sycamore Post oak	90 100 --- --- --- ---	Eastern cottonwood, red maple, American sycamore, sweetgum, pin oak, baldcypress.
422 Cape	2w	Slight	Severe	Moderate	Moderate	Pin oak Eastern cottonwood Sweetgum Cherrybark oak American sycamore	90 100 --- --- ---	American sycamore, silver maple, sweetgum, eastern cottonwood.
426 Karnak	2w	Slight	Severe	Severe	Severe	Pin oak Swamp white oak Eastern cottonwood Green ash Silver maple	90 --- --- --- ---	Pin oak, swamp white oak, eastern cottonwood, green ash, red maple, baldcypress, sweetgum, water tupelo.
427 Burnside	1o	Slight	Slight	Slight	Slight	Eastern cottonwood Yellow-poplar American sycamore Cherrybark oak Sweetgum Southern red oak	105 95 --- --- --- ---	Black walnut, American sycamore, eastern cottonwood, pin oak, red maple.
456 Ware	---	---	---	---	---		---	Eastern cottonwood, yellow-poplar, American sycamore, black walnut, sweetgum, green ash.

TABLE 6.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Trees to plant
475----------------- Elsah	2f	Slight	Slight	Moderate	Slight	Eastern cottonwood-- American sycamore--- Sweetgum------------ Red maple----------- 	95 --- --- ---	Black walnut, yellow-poplar, green ash, sweetgum.
589----------------- Bowdre	2w	Slight	Moderate	Moderate	Slight	Cherrybark oak------ Eastern cottonwood-- Sweetgum------------ Water oak----------- 	90 110 95 95	Eastern cottonwood, sweetgum, American sycamore.
590----------------- Cairo	2w	Slight	Moderate	Severe	Slight	Pin oak------------- Baldcypress--------- Swamp white oak----- Eastern cottonwood-- Green ash----------- 	90 --- --- --- ---	Pin oak, baldcypress, eastern cottonwood, red maple, water tupelo.
682----------------- Medway	1o	Slight	Slight	Slight	Slight	Northern red oak---- Yellow-poplar------- Sugar maple--------- Eastern cottonwood-- 	85 95 --- ---	Eastern white pine, yellow-poplar, black walnut, Norway spruce, baldcypress.
787----------------- Banlic	2o	Slight	Slight	Slight	Slight	White oak----------- Pin oak------------- Southern red oak---- Yellow-poplar------- Black walnut-------- 	75 90 85 90 ---	Black walnut, sweetgum, white oak, yellow-poplar, American sycamore, green ash.
852E*: Alford--------------	1r	Moderate	Moderate	Slight	Slight	White oak----------- Yellow-poplar------- Sweetgum------------ 	90 98 76	Eastern white pine, red pine, black walnut, yellow-poplar, white ash, black locust.
Wellston-----------	2r	Moderate	Moderate	Slight	Slight	Northern red oak---- Yellow-poplar------- Virginia pine------- 	81 97 76	Eastern white pine, black walnut, yellow-poplar.
930F*: Alford-------------	1r	Moderate	Moderate	Slight	Slight	White oak----------- Yellow-poplar------- Sweetgum------------ 	90 98 76	Eastern white pine, red pine, black walnut, yellow-poplar, white ash, black locust.
Goss---------------	4f	Slight	Severe	Moderate	Slight	White oak----------- Shortleaf pine------ Post oak------------ Blackjack oak------- Black oak----------- 	60 --- --- --- ---	Shortleaf pine.
930G*: Goss---------------	4f	Moderate	Severe	Severe	Slight	White oak----------- Shortleaf pine------ Post oak------------ Blackjack oak------- Black oak----------- 	60 --- --- --- ---	Shortleaf pine.
Alford-------------	1r	Severe	Severe	Slight	Slight	White oak----------- Yellow-poplar------- Sweetgum------------ 	90 98 76	Eastern white pine, red pine, black walnut, yellow-poplar, white ash, black locust, loblolly pine, shortleaf pine.

See footnote at end of table.

TABLE 6.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Trees to plant
940E*:								
Zanesville	3r	Slight	Moderate	Slight	Moderate	Northern red oak Virginia pine	68 70	Virginia pine, eastern white pine, shortleaf pine, loblolly pine, eastern redcedar.
Westmore.								
954E*:								
Alford	1r	Moderate	Moderate	Slight	Slight	White oak Yellow-poplar Sweetgum	90 98 76	Eastern white pine, red pine, black walnut, yellow-poplar, white ash, black locust, Virginia pine.
Baxter	2r	Moderate	Moderate	Slight	Slight	Northern red oak Yellow-poplar Shortleaf pine	93 89 80	Eastern white pine, loblolly pine, shortleaf pine, black locust, yellow-poplar, Virginia pine.
977F*:								
Wellston.								
Neotoma	2r	Moderate	Moderate	Slight	Slight	Northern red oak Yellow-poplar	85 105	Eastern white pine, yellow-poplar.
1334 Birds	2w	Slight	Severe	Moderate	Slight	Eastern cottonwood Pin oak Sweetgum Cherrybark oak American sycamore	100 90 --- --- ---	Eastern cottonwood, red maple, American sycamore, baldcypress, water tupelo.
3071 Darwin	3w	Slight	Severe	Severe	Slight	Pin oak Swamp white oak Eastern cottonwood Green ash American sycamore	80 --- --- --- ---	Eastern cottonwood, American sycamore, red maple, green ash, pin oak.
3092 Sarpy	5s	Slight	Slight	Severe	Slight	Eastern cottonwood	60	Shortleaf pine, eastern redcedar.
3456 Ware	---	--------	--------	--------	--------		---	Eastern cottonwood, yellow-poplar, American sycamore, black walnut, sweetgum, green ash.
3590 Cairo	3w	Slight	Severe	Severe	Slight	Pin oak Swamp white oak Eastern cottonwood Green ash Baldcypress	90 --- --- --- ---	Pin oak, baldcypress, eastern cottonwood, red maple, water tupelo.
3682 Medway	1o	Slight	Slight	Slight	Slight	Northern red oak Yellow-poplar Sugar maple Eastern cottonwood	85 95 --- ---	Yellow-poplar, black walnut.
5308D* Alford	1o	Slight	Slight	Slight	Slight	White oak Yellow-poplar Sweetgum	90 98 76	Eastern white pine, red pine, black walnut, yellow-poplar, white ash, black locust, Virginia pine.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil]

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
71. Darwin	Redosier dogwood, forsythia.	Amur maple, silky dogwood, American cranberrybush.	Flowering dogwood, baldcypress, green ash.	Pin oak, red oak, sweetgum.	Eastern cottonwood.
75C. Drury	Redosier dogwood, gray dogwood, arrowwood.	Autumn-olive, silky dogwood.	Amur maple, Russian-olive.	Norway spruce, eastern redcedar, Douglas-fir.	Yellow-poplar, eastern cottonwood.
85. Jacob	Redosier dogwood, forsythia, common winterberry.	Silky dogwood	Amur maple, green ash, baldcypress.	Pin oak, sweetgum.	Eastern cottonwood, red maple.
92. Sarpy	Gray dogwood, common snowberry, indiancurrant coralberry.	Blackhaw, Russian-olive, autumn-olive, mallow ninebark.	Black willow, flowering dogwood.	Eastern cottonwood.	---
162. Gorham	American cranberrybush, forsythia, redosier dogwood.	Amur maple, silky dogwood.	Baldcypress, green ash.	Pin oak, sweetgum.	Eastern cottonwood, red maple, American sycamore.
164A. Stoy	Gray dogwood, American cranberrybush.	Autumn-olive, forsythia.	Russian-olive, flowering dogwood, Amur maple.	Norway spruce, eastern white pine, Douglas-fir.	Eastern cottonwood.
180. Dupo	American cranberrybush, redosier dogwood.	Russian-olive, autumn-olive, gray dogwood, forsythia.	Amur maple, baldcypress.	Green ash, black walnut.	Eastern cottonwood, yellow-poplar.
214B, 214C2, 214C3, 214D2, 214D3, 214E, 214E3. Hosmer	Cutleaf stag sumac, arrowwood, redosier dogwood.	Amur honeysuckle, autumn-olive.	White ash, flowering dogwood, eastern redcedar.	Norway spruce, white spruce, eastern white pine.	Eastern cottonwood.
284A. Tice	Gray dogwood, redosier dogwood.	Silky dogwood, autumn-olive.	Amur maple, flowering dogwood, Russian-olive.	Cherrybark oak, green ash.	Pin oak, eastern cottonwood, yellow-poplar.
308B2, 308C2, 308C3, 308D2, 308D3, 308E, 308E3. Alford	Arrowwood, redosier dogwood.	Amur honeysuckle, autumn-olive.	Flowering dogwood, baldcypress, Virginia pine.	Norway spruce, Douglas-fir, eastern white pine.	Eastern cottonwood, American sycamore.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of-- <8	8-15	16-25	26-35	>35
331 Haymond	Gray dogwood, arrowwood.	Late lilac, Amur honeysuckle, autumn-olive.	Amur maple, Russian-olive.	Eastern white pine, Norway spruce, Douglas-fir.	Eastern cottonwood, silver maple.
333 Wakeland	Gray dogwood, redosier dogwood, common winterberry.	Amur honeysuckle, silky dogwood.	Flowering dogwood, Amur maple, eastern redcedar.	Norway spruce, Douglas-fir, eastern white pine.	Eastern cottonwood.
334 Birds	Gray dogwood, redosier dogwood, common winterberry.	Silky dogwood, forsythia.	Amur maple, baldcypress.	Pin oak, green ash.	Eastern cottonwood, American sycamore, red maple.
420 Piopolis	Common winter-berry, redosier dogwood.	Forsythia, silky dogwood, Amur honeysuckle.	Amur maple, baldcypress.	Green ash, pin oak.	Eastern cottonwood, American sycamore, red maple.
422 Cape	Redosier dogwood, common winter-berry.	Silky dogwood, Amur honeysuckle, forsythia.	Amur maple, Russian-olive, baldcypress.	Green ash, pin oak.	Eastern cottonwood, American sycamore, silver maple.
426 Karnak	Gray dogwood, redosier dogwood, common winter-berry.	Silky dogwood, forsythia.	Baldcypress, Amur maple.	Pin oak, green ash.	Eastern cottonwood, red maple, silver maple.
427 Burnside	Redosier dogwood, gray dogwood.	Autumn-olive, Amur honeysuckle, silky dogwood.	Amur maple, Russian-olive.	Norway spruce, eastern white pine, Douglas-fir.	Eastern cottonwood, American sycamore.
456 Ware	American cranberrybush, Vanhoutte spirea.	Autumn-olive, silky dogwood.	Amur maple, Russian-olive, baldcypress.	Norway spruce, eastern white pine.	Eastern cottonwood, American sycamore, red maple.
475 Elsah	Gray dogwood, redosier dogwood.	Autumn-olive, silky dogwood.	Russian-olive, flowering dogwood, eastern redcedar.	Eastern white pine, Norway spruce.	Eastern cottonwood, American sycamore, red maple.
589 Bowdre	Redosier dogwood, gray dogwood.	Amur honeysuckle, silky dogwood.	Russian-olive, Amur maple.	Eastern white pine, Douglas-fir, Norway spruce.	Eastern cottonwood, American sycamore, red maple.
590 Cairo	Redosier dogwood, common winterberry.	Amur maple, silky dogwood.	Baldcypress, green ash.	Pin oak, sweetgum, water tupelo.	Eastern cottonwood, red maple, American sycamore.
682 Medway	Gray dogwood, redosier dogwood.	Silky dogwood, Amur honeysuckle, forsythia.	Eastern redcedar, autumn-olive.	Norway spruce, eastern white pine, Douglas-fir.	Eastern cottonwood, yellow-poplar.

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
787: Banlic	Gray dogwood, redosier dogwood, arrowwood.	Autumn-olive, silky dogwood.	Amur maple, flowering dogwood, eastern redcedar.	Eastern white pine, Norway spruce, Douglas-fir.	Eastern cottonwood.
801B*, 802D* Orthents					
852E*:					
Alford	Arrowwood, redosier dogwood.	Amur honeysuckle, autumn-olive.	Flowering dogwood, baldcypress, Virginia pine.	Norway spruce, eastern white pine, Douglas-fir.	Eastern cottonwood, American sycamore.
Wellston	Arrowwood, redosier dogwood.	Amur honeysuckle, autumn-olive.	Flowering dogwood, baldcypress, Virginia pine.	Norway spruce, eastern white pine, Douglas-fir.	Eastern cottonwood, American sycamore.
864*. Pits					
930F*:					
Alford	Arrowwood, redosier dogwood.	Autumn-olive, Amur honeysuckle.	Flowering dogwood, Virginia pine, shortleaf pine, eastern redcedar.	Eastern white pine, loblolly pine, honey-locust.	Eastern cottonwood.
Goss	Gray dogwood, indiancurrant coralberry, arrowwood.	Eastern redbud, Amur honeysuckle, autumn-olive.	Eastern redcedar, Virginia pine, flowering dogwood.	---	---
930G*:					
Goss	Gray dogwood, indiancurrant coralberry, arrowwood.	Eastern redbud, Amur honeysuckle, autumn-olive.	Eastern redcedar, Virginia pine, flowering dogwood.	---	---
Alford	Arrowwood, redosier dogwood.	Amur honeysuckle, autumn-olive.	Flowering dogwood, Virginia pine, shortleaf pine, eastern redcedar.	Eastern white pine, loblolly pine, honey-locust.	Eastern cottonwood.
940E*:					
Zanesville	Redosier dogwood, gray dogwood, arrowwood, indiancurrant coralberry.	Blackhaw, Amur honeysuckle. autumn-olive.	Flowering dogwood, eastern redcedar, Virginia pine.	American basswood, eastern white pine.	Eastern cottonwood.
Westmore	Redosier dogwood, arrowwood, gray dogwood.	Blackhaw, Amur honeysuckle, autumn-olive.	Flowering dogwood, eastern redcedar, Virginia pine.	American basswood, eastern white pine.	Eastern cottonwood.

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
954E*:					
Alford	Arrowwood, redosier dogwood.	Amur honeysuckle, autumn-olive.	Flowering dogwood, baldcypress, Virginia pine.	Norway spruce, eastern white pine, Douglas-fir.	Eastern cottonwood, American sycamore.
Baxter	Gray dogwood, redosier dogwood, arrowwood.	Autumn-olive, silky dogwood.	Flowering dogwood, Amur maple, eastern redcedar.	Norway spruce, Douglas-fir, eastern white pine.	Eastern cottonwood.
977F*:					
Wellston	Arrowwood, redosier dogwood.	Amur honeysuckle, autumn-olive.	Flowering dogwood, baldcypress, Virginia pine.	Norway spruce, eastern white pine, Douglas-fir.	Eastern cottonwood, American sycamore.
Neotoma	Gray dogwood, redosier dogwood, arrowwood.	Autumn-olive, silky dogwood.	Flowering dogwood, Amur maple, eastern redcedar.	Norway spruce, Douglas-fir, eastern white pine.	Eastern cottonwood.
1334 Birds	American cranberrybush, late lilac.	Forsythia, Amur maple.	Russian-olive, green ash, baldcypress.	Pin oak, sweetgum, river birch.	Eastern cottonwood.
1426 Karnak	American cranberrybush, late lilac.	Forsythia, Amur maple.	Russian-olive, green ash, baldcypress.	Pin oak, sweetgum, river birch. birch.	Eastern cottonwood.
3071 Darwin	Silky dogwood	Amur maple, flowering dogwood, American cranberrybush, forsythia.	---	Baldcypress, water tupelo.	---
3092 Sarpy	---	Blackhaw, Russian-olive, autumn-olive, mallow ninebark.	---	---	---
3456 Ware	---	Autumn-olive, late lilac.	Amur maple, Russian-olive.	---	Eastern cottonwood.
3590 Cairo	---	---	Amur maple, baldcypress, water tupelo.	---	---
3682 Medway	Redosier dogwood	Silky dogwood, Amur honeysuckle, forsythia.	Autumn-olive	Eastern white pine.	---
4426. Karnak					
5308D* Alford	Arrowwood, redosier dogwood.	Amur honeysuckle, autumn-olive.	Flowering dogwood, baldcypress, Virginia pine.	Norway spruce, eastern white pine, Douglas-fir.	Eastern cottonwood, American sycamore.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
71----------------- Darwin	Severe: wetness.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: low strength, wetness, shrink-swell.	Severe: too clayey, wetness.
75C--------------- Drury	Slight---------	Slight---------	Slight---------	Moderate: slope.	Severe: frost action.	Slight.
85----------------- Jacob	Severe: too clayey.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: low strength, wetness, shrink-swell.	Severe: too clayey, wetness.
92----------------- Sarpy	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: too sandy.
162---------------- Gorham	Severe: wetness, floods, cutbanks cave.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: wetness, frost action, low strength.	Severe: wetness, floods.
164A-------------- Stoy	Severe: wetness.	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: frost action, low strength.	Moderate: wetness.
180---------------- Dupo	Severe: wetness, floods.	Severe: floods, shrink-swell, wetness.	Severe: floods, wetness, shrink-swell.	Severe: floods, shrink-swell, wetness.	Severe: floods, frost action, low strength.	Severe: floods.
214B-------------- Hosmer	Slight---------	Slight---------	Moderate: wetness.	Moderate: slope.	Severe: frost action.	Slight.
214C2------------- Hosmer	Moderate: slope.	Moderate: slope.	Moderate: wetness, slope.	Severe: slope.	Severe: frost action.	Moderate: slope.
214C3------------- Hosmer	Moderate: slope.	Moderate: slope.	Moderate: wetness, slope.	Severe: slope.	Severe: frost action.	Moderate: too clayey, slope.
214D2, 214D3, 214E, 214E3------ Hosmer	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: frost action, slope.	Severe: slope.
284A-------------- Tice	Severe: wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: low strength, frost action.	Moderate: too clayey, wetness.
308B2------------- Alford	Slight---------	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: slope, shrink-swell, low strength.	Severe: frost action, low strength.	Slight.
308C2------------- Alford	Moderate: slope.	Moderate: slope, shrink-swell, low strength.	Moderate: slope, shrink-swell, low strength.	Severe: slope.	Severe: frost action, low strength.	Moderate: slope.
308C3------------- Alford	Moderate: slope.	Moderate: slope, shrink-swell, low strength.	Moderate: slope, shrink-swell, low strength.	Severe: slope.	Severe: frost action, low strength.	Moderate: too clayey, slope.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
308D2, 308D3, 308E, 308E3------ Alford	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: frost action, slope, low strength.	Severe: slope.
331--------------- Haymond	Moderate: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: frost action.	Slight.
333--------------- Wakeland	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, frost action.	Severe: floods.
334--------------- Birds	Severe: wetness, floods.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: wetness, frost action, floods.	Severe: floods, wetness.
420--------------- Piopolis	Severe: wetness, floods.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: wetness, frost action.	Severe: wetness, floods.
422--------------- Cape	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, low strength.	Severe: wetness.
426--------------- Karnak	Severe: wetness.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: low strength, wetness, frost action.	Severe: too clayey, wetness.
427--------------- Burnside	Severe: floods, large stones.	Severe: floods.	Severe: floods, depth to rock.	Severe: floods.	Severe: floods.	Moderate: floods, thin layer.
456--------------- Ware	Severe: cutbanks cave.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods, low strength, frost action.	Slight.
475--------------- Elsah	Severe: floods, large stones.	Severe: floods, large stones.	Severe: floods, large stones.	Severe: floods, large stones.	Severe: floods, large stones.	Severe: floods.
589--------------- Bowdre	Severe: wetness, too clayey.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell.	Severe: too clayey, wetness.
590--------------- Cairo	Severe: wetness, floods, cutbanks cave.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, low strength.	Severe: wetness, too clayey, floods.
682--------------- Medway	Severe: floods, wetness.	Severe: floods.	Severe: floods, wetness.	Severe: floods.	Severe: low strength, floods.	Moderate: floods, too clayey.
787--------------- Banlic	Severe: wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: frost action.	Moderate: wetness.
801B*, 802D*. Orthents						
852E*: Alford-----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: frost action, slope, low strength.	Severe: slope.

See footnote at end of table.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
852E*:						
Wellston	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, frost action.	Severe: slope.
864*. Pits						
930F*:						
Alford	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: frost action, slope, low strength.	Severe: slope.
Goss	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: small stones, slope.
930G*:						
Goss	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: small stones, slope.
Alford	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: frost action, slope, low strength.	Severe: slope.
940E*:						
Zanesville	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Westmore	Severe: slope.	Severe: slope, low strength, shrink-swell.	Severe: slope, low strength, shrink-swell.	Severe: slope, low strength, shrink-swell.	Severe: slope, low strength, frost action.	Severe: slope.
954E*:						
Alford	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: frost action, slope, low strength.	Severe: slope.
Baxter	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
977F*:						
Wellston	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, frost action.	Severe: slope.
Neotoma	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: small stones, slope.
1334 Birds	Severe: wetness, floods.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: wetness, frost action, floods.	Severe: floods, wetness.
1426 Karnak	Severe: floods, wetness.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: low strength, wetness, floods.	Severe: too clayey, wetness, floods.
3071 Darwin	Severe: wetness, floods.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: wetness, shrink-swell, floods.	Severe: too clayey, wetness, floods.

See footnote at end of table.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
3092-------------- Sarpy	Severe: cutbanks cave, floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
3456-------------- Ware	Severe: floods, cutbanks cave.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
3590-------------- Cairo	Severe: wetness, floods.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, low strength.	Severe: too clayey, wetness, floods.
3682-------------- Medway	Severe: floods, wetness.	Severe: floods.	Severe: floods, wetness.	Severe: floods.	Severe: low strength, floods.	Severe: floods.
4426-------------- Karnak	Severe: floods, wetness.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: low strength, wetness, floods.	Severe: too clayey, wetness, floods.
5308D*------------ Alford	Moderate: slope.	Moderate: slope, shrink-swell, low strength.	Moderate: slope, shrink-swell, low strength.	Severe: slope.	Severe: frost action, low strength.	Moderate: slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
71 Darwin	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, wetness.
75C Drury	Slight	Moderate: slope, seepage.	Slight	Slight	Good.
85 Jacob	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, wetness.
92 Sarpy	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: too sandy, seepage.
162 Gorham	Severe: wetness, floods.	Severe: wetness, seepage.	Severe: wetness, floods, seepage.	Severe: wetness, floods, seepage.	Poor: wetness, too clayey.
164A Stoy	Severe: percs slowly, wetness.	Slight	Severe: wetness.	Severe: wetness.	Poor: wetness.
180 Dupo	Severe: percs slowly, wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods, too clayey.	Severe: wetness, floods.	Poor: wetness.
214B Hosmer	Severe: percs slowly.	Severe: wetness.	Moderate: wetness.	Slight	Fair: wetness.
214C2, 214C3 Hosmer	Severe: percs slowly.	Severe: slope, wetness.	Moderate: wetness.	Moderate: slope.	Fair: slope, wetness.
214D2, 214D3, 214E, 214E3 Hosmer	Severe: percs slowly, slope.	Severe: slope, wetness.	Moderate: slope, wetness.	Severe: slope.	Poor: slope.
284A Tice	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
308B2 Alford	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
308C2, 308C3 Alford	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.	Fair: slope.
308D2, 308D3, 308E, 308E3 Alford	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.	Poor: slope.
331 Haymond	Moderate: floods, percs slowly.	Severe: floods.	Moderate: floods.	Moderate: floods.	Good.
333 Wakeland	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
334 Birds	Severe: wetness, floods, percs slowly.	Severe: wetness, floods.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
420 Piopolis	Severe: percs slowly, floods, wetness.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
422 Cape	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: wetness, too clayey.
426 Karnak	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, wetness.
427 Burnside	Severe: floods, depth to rock, wetness.	Severe: floods, depth to rock, wetness.	Severe: floods, depth to rock, wetness.	Severe: floods, wetness.	Poor: large stones, small stones.
456 Ware	Moderate: wetness, floods.	Severe: seepage.	Severe: seepage, wetness, too sandy.	Severe: seepage.	Poor: too sandy.
475 Elsah	Severe: floods, large stones.	Severe: seepage, floods, large stones.	Severe: floods, seepage, large stones.	Severe: floods, seepage.	Poor: large stones, small stones.
589 Bowdre	Severe: wetness, percs slowly.	Severe: wetness, seepage.	Severe: too clayey.	Severe: wetness.	Poor: too clayey.
590 Cairo	Severe: percs slowly, wetness, floods.	Severe: seepage, wetness, floods.	Severe: wetness, floods, seepage.	Severe: wetness, floods, seepage.	Poor: too clayey, wetness.
682 Medway	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, seepage, wetness.	Severe: floods, wetness.	Fair: wetness.
787 Banlic	Severe: percs slowly, wetness.	Slight	Severe: wetness.	Severe: wetness.	Good.
801B*, 802D*. Orthents					
852E*:					
Alford	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.	Poor: slope.
Wellston	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock.	Severe: slope.	Poor: slope.
864*. Pits					
930F*:					
Alford	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.

See footnote at end of table.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
930F*:					
Goss	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: small stones, slope.
930G*:					
Goss	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: small stones, slope.
Alford	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
940E*:					
Zanesville	Severe: slope, percs slowly, wetness.	Severe: slope.	Severe: depth to rock, wetness.	Severe: slope.	Poor: slope.
Westmore	Severe: slope, percs slowly.	Severe: slope.	Severe: depth to rock.	Severe: slope.	Poor: slope, too clayey.
954E*:					
Alford	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.	Poor: slope.
Baxter	Severe: slope.	Severe: slope.	Moderate: slope, too clayey.	Severe: slope.	Poor: slope, too clayey.
977F*:					
Wellston	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Neotoma	Severe: slope.	Severe: seepage, slope.	Severe: depth to rock, slope, seepage.	Severe: slope, seepage.	Poor: slope, small stones.
1334 Birds	Severe: wetness, floods, percs slowly.	Severe: wetness, floods.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
1426 Karnak	Severe: percs slowly, floods, wetness.	Severe: floods, wetness.	Severe: too clayey, wetness, floods.	Severe: floods, wetness.	Poor: wetness, too clayey.
3071 Darwin	Severe: percs slowly, wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods, too clayey.	Severe: wetness, floods.	Poor: too clayey, wetness.
3092 Sarpy	Severe: floods.	Severe: seepage, floods.	Severe: seepage, floods.	Severe: seepage, floods.	Poor: too sandy, seepage.
3456 Ware	Severe: floods.	Severe: floods, seepage.	Severe: floods, seepage, too sandy.	Severe: floods, seepage.	Poor: too sandy.

See footnote at end of table.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
3590----------------- Cairo	Severe: percs slowly, wetness, floods.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: too clayey, wetness.
3682----------------- Medway	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, seepage, wetness.	Severe: floods, wetness.	Fair: wetness.
4426----------------- Karnak	Severe: percs slowly, floods, wetness.	Severe: floods, wetness.	Severe: too clayey, wetness, floods.	Severe: floods, wetness.	Poor: wetness, too clayey.
5308D*--------------- Alford	Severe: slope, seepage.	Severe: slope, seepage.	Severe: seepage.	Moderate: slope.	Fair: slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and "poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
71 Darwin	Poor: low strength, wetness, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey, wetness.
75C Drury	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
85 Jacob	Poor: low strength, wetness, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey, wetness.
92 Sarpy	Good	Poor: excess fines.	Unsuited: excess fines.	Fair: too sandy.
162 Gorham	Poor: wetness, low strength.	Fair: excess fines.	Unsuited: excess fines.	Poor: wetness.
164A Stoy	Poor: low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
180 Dupo	Poor: wetness, low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
214B Hosmer	Fair: low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
214C2 Hosmer	Fair: low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.
214C3 Hosmer	Fair: low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey, slope.
214D2, 214D3, 214E, 214E3 Hosmer	Fair: low strength, slope, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
284A Tice	Poor: low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
308B2 Alford	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
308C2 Alford	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.
308C3 Alford	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey, slope.
308D2, 308D3, 308E, 308E3 Alford	Fair: low strength, slope.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
331------------------- Haymond	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
333------------------- Wakeland	Poor: wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
334------------------- Birds	Poor: wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
420------------------- Piopolis	Poor: wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
422------------------- Cape	Poor: wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
426------------------- Karnak	Poor: low strength, wetness, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey, wetness.
427------------------- Burnside	Fair: area reclaim, low strength.	Poor: thin layer, excess fines.	Poor: thin layer, excess fines.	Fair: area reclaim.
456------------------- Ware	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Good.
475------------------- Elsah	Poor: large stones.	Poor: large stones, excess fines.	Poor: excess fines, large stones.	Fair: thin layer.
589------------------- Bowdre	Poor: shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
590------------------- Cairo	Poor: wetness, shrink-swell, low strength.	Poor: excess fines.	Unsuited: excess fines.	Poor: too clayey, wetness.
682------------------- Medway	Fair: wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
787------------------- Banlic	Poor: wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer.
801B*, 802D*. Orthents				
852E*:				
Alford---------------	Fair: low strength, slope.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
Wellston-------------	Fair: low strength, slope, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
864*. Pits				
930F*:				
Alford---------------	Poor: slope.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.

See footnote at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
930F*:				
Goss	Poor: slope.	Unsuited	Unsuited: excess fines.	Poor: small stones, slope.
930G*:				
Goss	Poor: slope.	Unsuited	Unsuited: excess fines.	Poor: small stones, slope.
Alford	Poor: slope.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
940E*:				
Zanesville	Fair: low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
Westmore	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
954E*:				
Alford	Fair: low strength, slope.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
Baxter	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, small stones, too clayey.
977F*:				
Wellston	Poor: slope.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
Neotoma	Poor: slope, thin layer, area reclaim.	Unsuited: large stones.	Unsuited: large stones.	Poor: slope, large stones.
1334 Birds	Poor: wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
1426 Karnak	Poor: wetness, shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey, wetness.
3071 Darwin	Poor: shrink-swell, wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey, wetness.
3092 Sarpy	Good	Poor: excess fines.	Unsuited: excess fines.	Fair: too sandy.
3456 Ware	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Good.
3590 Cairo	Poor: wetness, shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey, wetness.
3682 Medway	Fair: wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.

See footnote at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
4426 Karnak	Poor: wetness, shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey, wetness.
5308D* Alford	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. Absence of an entry indicates that the soil was not evaluated]

Soil name and map symbol	Limitations for--		Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Terraces and diversions	Grassed waterways
71: Darwin	Favorable	Wetness	Percs slowly	Not needed	Wetness, percs slowly.
75C: Drury	Seepage, slope.	Piping	Not needed	Favorable	Erodes easily.
85: Jacob	Favorable	Wetness	Percs slowly	Not needed	Wetness, percs slowly.
92: Sarpy	Seepage	Piping, seepage.	Not needed	Not needed	Droughty.
162: Gorham	Seepage	Wetness	Floods, frost action.	Not needed	Wetness.
164A: Stoy	Favorable	Wetness	Percs slowly, frost action.	Not needed	Wetness, erodes easily.
180: Dupo	Favorable	Hard to pack, wetness.	Percs slowly, floods, frost action.	Not needed	Wetness, erodes easily, percs slowly.
214B: Hosmer	Favorable	Piping	Not needed	Rooting depth, erodes easily.	Erodes easily, rooting depth.
214C2, 214C3: Hosmer	Favorable	Piping	Not needed	Rooting depth, erodes easily.	Slope, erodes easily, rooting depth.
214D2, 214D3, 214E, 214E3: Hosmer	Favorable	Piping	Not needed	Slope, erodes easily, rooting depth.	Slope, erodes easily, rooting depth.
284A: Tice	Seepage	Wetness	Frost action	Not needed	Wetness.
308B2: Alford	Seepage	Favorable	Not needed	Favorable	Erodes easily.
308C2, 308C3: Alford	Slope, seepage.	Favorable	Not needed	Favorable	Slope, erodes easily.
308D2, 308D3, 308E, 308E3: Alford	Slope, seepage.	Favorable	Not needed	Slope	Slope, erodes easily.
331: Haymond	Seepage	Piping	Not needed	Not needed	Erodes easily.
333: Wakeland	Seepage	Piping, wetness.	Frost action, floods.	Not needed	Wetness, erodes easily.
334: Birds	Favorable	Wetness	Floods, frost action.	Not needed	Wetness, erodes easily.
420: Piopolis	Favorable	Wetness	Floods, frost action, percs slowly.	Not needed	Wetness, erodes easily, percs slowly.
422: Cape	Favorable	Wetness, hard to pack.	Percs slowly, frost action.	Not needed	Wetness, percs slowly.
426: Karnak	Favorable	Wetness	Percs slowly, frost action.	Not needed	Wetness, percs slowly.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
427: Burnside	Seepage, depth to rock.	Seepage	Not needed	Large stones, small stones.	Erodes easily, large stones, depth to rock.
456: Ware	Seepage	Piping, seepage.	Not needed	Too sandy	Favorable.
475: Elsah	Seepage	Large stones, seepage.	Not needed	Large stones	Large stones.
589: Bowdre	Severe: seepage.	Moderate: seepage, piping.	Wetness, percs slowly.	Percs slowly, wetness.	Percs slowly, wetness.
590: Cairo	Seepage	Hard to pack, wetness.	Floods, percs slowly.	Wetness, percs slowly, too sandy.	Wetness, percs slowly.
682: Medway	Seepage	Piping, wetness.	Frost action, floods.	Not needed	Favorable.
787: Banlic	Favorable	Piping, wetness.	Percs slowly, frost action.	Not needed	Wetness, percs slowly, erodes easily.
801B*, 802D*. Orthents					
852E*:					
Alford	Slope, seepage.	Favorable	Not needed	Slope	Slope, erodes easily.
Wellston	Slope, seepage, depth to rock.	Thin layer	Not needed	Slope	Erodes easily, slope.
864*. Pits					
930F*:					
Alford	Slope, seepage.	Favorable	Not needed	Slope	Slope, erodes easily.
Goss	Seepage, slope.	Large stones	Not needed	Slope, large stones.	Slope, droughty, large stones.
930G*:					
Goss	Seepage, slope.	Large stones	Not needed	Slope, large stones.	Slope, droughty, large stones.
Alford	Slope, seepage.	Favorable	Not needed	Slope	Slope, erodes easily.
940E*:					
Zanesville	Depth to rock, seepage.	Piping, thin layer, wetness.	Percs slowly, slope.	Slope, percs slowly, erodes easily.	Percs slowly, erodes easily, slope.
Westmore	Slope, depth to rock.	Hard to pack	Not needed	Percs slowly, slope.	Slope, erodes easily, percs slowly.
954E*:					
Alford	Slope, seepage.	Favorable	Not needed	Slope	Slope, erodes easily.

See footnote at end of table.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
954E*:					
Baxter	Favorable	Low strength, hard to pack.	Not needed	Slope, erodes easily.	Slope, erodes easily.
977F*:					
Wellston	Slope, seepage, depth to rock.	Thin layer	Not needed	Slope	Erodes easily, slope.
Neotoma	Depth to rock, slope, seepage.	Thin layer, piping, seepage.	Not needed	Slope, large stones.	Slope, large stones.
1334 Birds	Favorable	Wetness	Floods, frost action.	Not needed	Wetness, erodes easily.
1426 Karnak	Favorable	Wetness, hard to pack.	Percs slowly, floods, frost action.	Not needed	Wetness, percs slowly.
3071 Darwin	Favorable	Hard to pack, wetness.	Percs slowly, floods.	Not needed	Wetness, percs slowly.
3092 Sarpy	Seepage	Piping, seepage.	Not needed	Not needed	Droughty.
3456 Ware	Seepage	Piping, seepage.	Not needed	Too sandy	Favorable.
3590 Cairo	Favorable	Wetness, hard to pack.	Floods	Wetness, percs slowly.	Wetness, percs slowly.
3682 Medway	Seepage	Piping, wetness.	Frost action, floods.	Not needed	Favorable.
4426 Karnak	Favorable	Wetness, hard to pack.	Percs slowly, floods, frost action.	Not needed	Wetness, percs slowly.
5308D* Alford	Slope, seepage.	Favorable	Not needed	Favorable	Slope, erodes easily.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
71 Darwin	Severe: floods, wetness, percs slowly.	Severe: wetness, too clayey.	Severe: too clayey, wetness, percs slowly.	Severe: wetness, too clayey.	Severe: too clayey, wetness.
75C Drury	Slight	Slight	Severe: slope.	Slight	Slight.
85 Jacob	Severe: floods, wetness, percs slowly.	Severe: wetness, too clayey.	Severe: too clayey, wetness, percs slowly.	Severe: wetness, too clayey.	Severe: too clayey, wetness.
92 Sarpy	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
162 Gorham	Severe: floods, wetness.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.
164A Stoy	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
180 Dupo	Severe: floods, wetness.	Moderate: floods, wetness.	Severe: floods, wetness.	Moderate: wetness, floods.	Severe: floods.
214B Hosmer	Severe: percs slowly.	Slight	Severe: percs slowly.	Slight	Slight.
214C2 Hosmer	Severe: percs slowly.	Moderate: slope.	Severe: percs slowly, slope.	Slight	Moderate: slope.
214C3 Hosmer	Severe: percs slowly.	Moderate: slope, too clayey.	Severe: percs slowly, slope.	Moderate: too clayey.	Moderate: too clayey, slope.
214D2 Hosmer	Severe: slope, percs slowly.	Severe: slope.	Severe: percs slowly, slope.	Moderate: slope.	Severe: slope.
214D3 Hosmer	Severe: slope, percs slowly.	Severe: slope.	Severe: percs slowly, slope.	Moderate: too clayey, slope.	Severe: slope.
214E Hosmer	Severe: slope, percs slowly.	Severe: slope.	Severe: percs slowly, slope.	Moderate: slope.	Severe: slope.
214E3 Hosmer	Severe: slope, percs slowly.	Severe: slope.	Severe: percs slowly, slope.	Moderate: too clayey, slope.	Severe: slope.
284A Tice	Severe: floods, wetness.	Moderate: wetness, too clayey.	Severe: wetness.	Moderate: wetness, too clayey.	Moderate: too clayey, wetness.
308B2 Alford	Slight	Slight	Moderate: slope.	Slight	Slight.
308C2 Alford	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.

TABLE 12.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
308C3 Alford	Moderate: slope, too clayey.	Moderate: slope, too clayey.	Severe: slope.	Moderate: too clayey.	Moderate: too clayey, slope.
308D2 Alford	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
308D3 Alford	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: too clayey, slope.	Severe: slope.
308E Alford	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
308E3 Alford	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: too clayey, slope.	Severe: slope.
331 Haymond	Severe: floods.	Slight	Slight	Slight	Slight.
333 Wakeland	Severe: floods, wetness.	Moderate: floods, wetness.	Severe: floods, wetness.	Moderate: floods, wetness.	Severe: floods.
334 Birds	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.	Severe: floods, wetness.
420 Piopolis	Severe: floods, wetness.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.
422 Cape	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.
426 Karnak	Severe: floods, wetness, percs slowly.	Severe: wetness, too clayey.	Severe: too clayey, wetness.	Severe: wetness.	Severe: too clayey, wetness.
427 Burnside	Severe: floods.	Slight	Moderate: slope, floods, depth to rock.	Slight	Moderate: floods, thin layer.
456 Ware	Severe: floods.	Slight	Moderate: slope.	Slight	Slight.
475 Elsah	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.	Severe: floods.
589 Bowdre	Severe: wetness, too clayey, percs slowly.	Severe: wetness, too clayey.	Severe: wetness, percs slowly, too clayey.	Severe: wetness, too clayey.	
590 Cairo	Severe: floods, wetness, percs slowly.	Severe: wetness, too clayey.	Severe: too clayey, wetness, floods.	Severe: wetness, too clayey.	Severe: wetness, too clayey, floods.
682 Medway	Severe: floods.	Moderate: wetness.	Moderate: wetness.	Moderate: too clayey.	Moderate: floods, too clayey.
787 Banlic	Severe: floods, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.

TABLE 12.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
801B*, 802D*. Orthents					
852E*:					
Alford	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Wellston	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
864*. Pits					
930F*:					
Alford	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Goss	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: small stones, slope.
930G*:					
Goss	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: small stones, slope.
Alford	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
940E*:					
Zanesville	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Westmore	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
954E*:					
Alford	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Baxter	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
977F*:					
Wellston	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Neotoma	Severe: slope.	Severe: slope.	Severe: slope, large stones.	Severe: slope.	Severe: small stones, slope.
1334 Birds	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.	Severe: floods, wetness.
1426 Karnak	Severe: floods, wetness, too clayey.	Severe: wetness, too clayey.	Severe: too clayey, wetness, floods.	Severe: wetness, too clayey.	Severe: too clayey, wetness, floods.
3071 Darwin	Severe: wetness, floods, percs slowly.	Severe: wetness, too clayey.	Severe: too clayey, wetness, floods.	Severe: wetness, too clayey.	Severe: too clayey, wetness, floods.
3092 Sarpy	Severe: floods.	Moderate: too sandy.	Severe: floods.	Moderate: too sandy.	Severe: floods.

See footnote at end of table.

TABLE 12.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
3456------------------ Ware	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.	Severe: floods.
3590------------------ Cairo	Severe: floods, wetness, percs slowly.	Severe: wetness, too clayey.	Severe: too clayey, wetness, floods.	Severe: wetness, too clayey.	Severe: too clayey, wetness, floods.
3682------------------ Medway	Severe: floods.	Moderate: floods, wetness.	Severe: floods.	Moderate: too clayey, floods.	Severe: floods.
4426------------------ Karnak	Severe: floods, wetness, too clayey.	Severe: wetness, too clayey.	Severe: too clayey, wetness, floods.	Severe: wetness, too clayey.	Severe: too clayey, wetness, floods.
5308D*---------------- Alford	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight------------	Moderate: slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba-ceous plants	Hardwood trees	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
71 Darwin	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
75C Drury	Fair	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor.
85 Jacob	Poor	Fair	Fair	Fair	Poor	Good	Fair	Fair	Fair.
92 Sarpy	Poor	Poor	Fair	Poor	Very poor	Very poor	Poor	Poor	Very poor.
162 Gorham	Good	Fair	Good	Fair	Good	Fair	Good	Fair	Fair.
164A Stoy	Fair	Good	Good	Good	Fair	Fair	Good	Good	Fair.
180 Dupo	Good	Good	Good	Good	Fair	Good	Good	Good	Fair.
214B Hosmer	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
214C2, 214C3 Hosmer	Fair	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor.
214D2, 214D3 Hosmer	Poor	Fair	Good	Good	Very poor	Very poor	Fair	Good	Very poor.
214E, 214E3 Hosmer	Very poor	Fair	Good	Good	Very poor	Very poor	Fair	Good	Very poor.
284A Tice	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
308B2 Alford	Good	Good	Good	Good	Poor	Very poor	Good	Good	Very poor.
308C2, 308C3 Alford	Fair	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor.
308D2, 308D3, 308E, 308E3 Alford	Poor	Fair	Good	Good	Very poor	Very poor	Fair	Good	Very poor.
331 Haymond	Good	Good	Fair	Good	Poor	Poor	Good	Good	Poor.
333 Wakeland	Poor	Fair	Fair	Good	Fair	Fair	Fair	Good	Fair.
334 Birds	Good	Fair	Good	Good	Good	Good	Good	Good	Good.
420 Piopolis	Poor	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
422 Cape	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
426 Karnak	Very poor	Poor	Poor	Good	Good	Good	Poor	Fair	Good.

TABLE 13.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
427----------------- Burnside	Fair	Good	Good	Good	Poor	Poor	Good	Good	Poor.
456----------------- Ware	Good	Good	Good	Good	Poor	Very poor	Good	Good	Very poor.
475----------------- Elsah	Fair	Fair	Fair	Good	Poor	Poor	Fair	Good	Poor.
589----------------- Bowdre	Fair	Fair	Fair	Fair	Poor	Fair	Fair	Fair	Poor.
590----------------- Cairo	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair.
682----------------- Medway	Good	Good	Fair	Good	Poor	Poor	Good	Good	Poor.
787----------------- Banlic	Fair	Good	Good	Good	Fair	Fair	Good	Good	Fair.
801B*, 802D*. Orthents									
852E*: Alford------------	Poor	Fair	Good	Good	Very poor	Very poor	Fair	Good	Very poor.
Wellston----------	Poor	Fair	Good	Good	Very poor	Very poor	Fair	Good	Very poor.
864*. Pits									
930F*: Alford------------	Very poor	Poor	Good	Good	Very poor	Very poor	Poor	Good	Very poor.
Goss--------------	Very poor	Poor	Fair	Fair	Very poor	Very poor	Poor	Fair	Very poor.
930G*: Goss--------------	Very poor	Poor	Fair	Fair	Very poor	Very poor	Poor	Fair	Very poor.
Alford------------	Very poor	Poor	Good	Good	Very poor	Very poor	Poor	Good	Very poor.
940E*: Zanesville--------	Poor	Fair	Good	Good	Very poor	Very poor	Fair	Good	Very poor.
Westmore----------	Poor	Fair	Good	Good	Very poor	Very poor	Fair	Good	Very poor.
954E*: Alford------------	Poor	Fair	Good	Good	Very poor	Very poor	Fair	Good	Very poor.
Baxter------------	Poor	Fair	Good	Good	Very poor	Very poor	Fair	Good	Very poor.
977F*: Wellston----------	Very poor	Fair	Good	Good	Very poor	Very poor	Fair	Good	Very poor.

See footnote at end of table.

TABLE 13.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
977F*:									
Neotoma-----------	Very poor	Fair	Good	Good	Very poor	Very poor	Fair	Good	Very poor.
1334--------------- Birds	Poor	Fair	Good	Good	Good	Good	Fair	Good	Good.
1426--------------- Karnak	Very poor	Poor	Poor	Fair	Good	Good	Poor	Fair	Good.
3071--------------- Darwin	Poor	Poor	Fair	Poor	Good	Good	Poor	Poor	Good.
3092--------------- Sarpy	Poor	Poor	Fair	Poor	Very poor	Very poor	Poor	Poor	Very poor.
3456--------------- Ware	Fair	Good	Good	Good	Fair	Poor	Good	Good	Fair.
3590--------------- Cairo	Poor	Poor	Fair	Fair	Good	Good	Poor	Fair	Good.
3682--------------- Medway	Poor	Fair	Fair	Good	Poor	Poor	Fair	Good	Poor.
4426--------------- Karnak	Very poor	Poor	Poor	Fair	Good	Good	Poor	Fair	Good.
5308D*------------- Alford	Fair	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
71----------------- Darwin	0-10	Silty clay------	CH	A-7	0	100	100	100	95-100	50-85	30-55
	10-62	Silty clay, clay, silty clay loam.	CH	A-7	0	100	100	100	95-100	50-85	30-55
75C---------------- Drury	0-6	Silt loam-------	CL, CL-ML	A-4, A-6	0	100	100	100	90-100	25-35	5-15
	6-68	Silt loam-------	CL	A-6, A-4	0	100	100	95-100	90-100	25-35	8-15
85----------------- Jacob	0-9	Silty clay------	CH	A-7	0	100	100	100	95-100	54-70	33-45
	9-60	Clay, silty clay	CH	A-7	0	100	100	100	95-100	50-70	30-45
92----------------- Sarpy	0-14	Loamy fine sand	SM	A-2	0	100	100	60-80	15-35	---	NP
	14-60	Loamy fine sand, fine sand.	SM	A-2	0	100	100	60-80	15-35	---	NP
162---------------- Gorham	0-11	Silty clay loam	CL	A-6, A-7	0	100	95-100	90-100	70-90	35-50	15-25
	11-43	Silty clay loam, silty clay, clay loam.	CL	A-6, A-7	0	100	95-100	90-100	50-90	25-50	15-30
	43-60	Sand, loamy fine sand, sandy loam.	SM, SP-SM, SC, SM-SC	A-2, A-4	0	100	65-90	55-80	10-50	<30	NP-10
164A--------------- Stoy	0-10	Silt loam-------	ML, CL, CL-ML	A-4, A-6	0	100	100	95-100	90-100	20-33	3-14
	10-32	Silty clay loam, silt loam.	CL	A-7, A-6	0	100	100	95-100	90-100	35-50	22-32
	32-50	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	90-100	35-50	15-25
	50-60	Silt loam-------	CL	A-6, A-7	0	100	100	95-100	90-100	30-45	13-25
180---------------- Dupo	0-10	Silt loam-------	ML, CL, CL-ML	A-4, A-6	0	100	100	100	95-100	20-35	1-15
	10-24	Silt loam-------	ML, CL, CL-ML	A-4, A-6	0	100	100	100	95-100	20-35	5-15
	24-65	Silty clay, clay, silty clay loam.	CL, CH	A-7, A-6	0	100	100	100	98-100	35-55	15-30
214B, 214C2-------- Hosmer	0-7	Silt loam-------	CL, CL-ML	A-4, A-6	0	100	100	90-100	80-100	25-35	5-15
	7-28	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	100	100	90-100	80-100	25-35	5-15
	28-55	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	100	100	90-100	80-100	25-35	5-15
	55-73	Silt loam-------	CL, CL-ML	A-4, A-6	0	100	100	90-100	80-100	25-35	5-15
214C3-------------- Hosmer	0-5	Silty clay loam	CL	A-6	0	100	100	90-100	80-100	30-40	10-20
	5-12	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	100	100	90-100	80-100	25-35	5-15
	12-44	Silt loam-------	CL, CL-ML	A-4, A-6	0	100	100	90-100	80-100	25-35	5-15
	44-60	Silt loam-------	CL, CL-ML	A-4, A-6	0	100	100	90-100	80-100	25-35	5-15
214D2-------------- Hosmer	0-7	Silt loam-------	CL, CL-ML	A-4, A-6	0	100	100	90-100	80-100	25-35	5-15
	7-28	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	100	100	90-100	80-100	25-35	5-15
	28-55	Silt loam-------	CL, CL-ML	A-4, A-6	0	100	100	90-100	80-100	25-35	5-15
	55-73	Silt loam-------	CL, CL-ML	A-4, A-6	0	100	100	90-100	80-100	25-35	5-15
214D3-------------- Hosmer	0-5	Silty clay loam	CL	A-6	0	100	100	90-100	80-100	30-40	10-20
	5-12	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	100	100	90-100	80-100	25-35	5-15
	12-44	Silt loam-------	CL, CL-ML	A-4, A-6	0	100	100	90-100	80-100	25-35	5-15
	44-60	Silt loam-------	CL, CL-ML	A-4, A-6	0	100	100	90-100	80-100	25-35	5-15
214E--------------- Hosmer	0-7	Silt loam-------	CL, CL-ML	A-4, A-6	0	100	100	90-100	80-100	25-35	5-15
	7-28	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	100	100	90-100	80-100	25-35	5-15
	28-55	Silt loam-------	CL, CL-ML	A-4, A-6	0	100	100	90-100	80-100	25-35	5-15
	55-73	Silt loam-------	CL, CL-ML	A-4, A-6	0	100	100	90-100	80-100	25-35	5-15

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
214E3-------------- Hosmer	0-5	Silty clay loam	CL	A-6	0	100	100	90-100	80-100	30-40	10-20
	5-12	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	100	100	90-100	80-100	25-35	5-15
	12-44	Silt loam-------	CL, CL-ML	A-4, A-6	0	100	100	90-100	80-100	25-35	5-15
	44-60	Silt loam-------	CL, CL-ML	A-4, A-6	0	100	100	90-100	80-100	25-35	5-15
284A--------------- Tice	0-11	Silty clay loam	CL	A-6, A-7	0	100	100	92-100	70-95	32-45	12-22
	11-60	Silty clay loam, clay loam.	CL	A-6, A-7	0	100	100	92-100	70-95	35-45	12-22
308B2, 308C2------- Alford	0-8	Silt loam-------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-100	25-40	5-15
	8-48	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	90-100	80-100	30-50	15-30
	48-70	Silt loam, silt	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-100	25-40	5-15
308C3-------------- Alford	0-3	Silty clay loam	CL	A-6, A-7	0	100	100	90-100	80-100	30-50	15-30
	3-45	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	90-100	80-100	30-50	15-30
	45-60	Silt loam, silt	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-100	25-40	5-15
308D2-------------- Alford	0-8	Silt loam-------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-100	25-40	5-15
	0-48	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	90-100	80-100	30-50	15-30
	48-70	Silt loam, silt	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-100	25-40	5-15
308D3-------------- Alford	0-3	Silty clay loam	CL	A-6, A-7	0	100	100	90-100	80-100	30-50	15-30
	3-45	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	90-100	80-100	30-50	15-30
	45-60	Silt loam, silt	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-100	25-40	5-15
308E--------------- Alford	0-8	Silt loam-------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-100	25-40	5-15
	8-48	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	90-100	80-100	30-50	15-30
	48-70	Silt loam, silt	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-100	25-40	5-15
308E3-------------- Alford	0-3	Silty clay loam	CL	A-6, A-7	0	100	100	90-100	80-100	30-50	15-30
	3-45	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	90-100	80-100	30-50	15-30
	45-60	Silt loam, silt	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-100	25-40	5-15
331---------------- Haymond	0-20	Silt loam-------	ML	A-4	0	100	100	90-100	80-90	27-36	4-10
	20-62	Silt loam-------	ML	A-4	0	100	100	90-100	80-90	27-36	4-10
333---------------- Wakeland	0-7	Silt loam-------	ML	A-4	0	100	100	90-100	80-90	27-36	4-10
	7-60	Silt loam-------	ML	A-4	0	100	100	90-100	80-90	27-36	4-10
334---------------- Birds	0-11	Silt loam-------	CL	A-4, A-6	0	100	95-100	90-100	80-100	24-34	8-15
	11-60	Silt loam-------	CL	A-4, A-6	0	100	95-100	90-100	80-100	24-34	8-15
420---------------- Piopolis	0-7	Silty clay loam	CL	A-6	0	100	100	90-100	75-95	30-40	15-20
	7-45	Silty clay loam	CL	A-6	0	100	100	90-100	75-95	30-40	15-20
	45-60	Silty clay loam, silt loam.	CL	A-6	0	100	100	90-100	70-95	30-40	15-20
422---------------- Cape	0-12	Silty clay loam	CL	A-6, A-7	0	100	100	100	95-100	36-50	20-30
	12-47	Silty clay, silty clay loam	CH	A-7	0	100	100	100	95-100	50-70	30-45
	47-60	Silty clay loam, silty clay.	CL	A-6, A-7	0	100	100	100	90-100	36-50	20-30
426---------------- Karnak	0-6	Silty clay------	CH, CL, MH	A-7	0	100	100	95-100	95-100	45-80	25-45
	6-75	Silty clay, clay	CH, MH, CL	A-7	0	100	100	95-100	95-100	45-80	23-38
427---------------- Burnside	0-14	Loam------------	ML, CL, CL-ML	A-4	0-10	100	100	80-95	75-95	20-35	2-10
	14-63	Flaggy loam, flaggy sandy loam, channery loam.	SC, GC, SM, GM	A-2, A-4	10-60	35-80	30-60	30-50	26-45	<20	NP-10
	63-69	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

TABLE 14--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
456------------- Ware	0-21	Loam, fine sandy loam.	ML, CL-ML, CL	A-4	0	100	100	95-100	50-70	20-36	2-10
	21-60	Stratified silt loam to sand.	SM, ML, SM-SC, CL-ML	A-4, A-2	0	100	100	60-90	10-60	<25	NP-6
475------------- Elsah	0-15	Silt loam--------	CL-ML, CL	A-4, A-6	0-15	100	95-100	95-100	85-100	22-32	4-12
	15-40	Cherty loam, very cherty loam, very cherty sand.	SM, ML, CL	A-2, A-4	15-60	80-90	70-85	60-80	30-70	<30	NP-8
	40-60	Very cherty loam, very cobbly loam.	GM, GP-GM	A-1	60-85	20-50	20-45	20-40	10-25	<30	NP-6
589------------- Bowdre	0-17	Silty clay-------	CH	A-7	0	100	100	95-100	90-95	51-65	28-40
	17-23	Silt loam, loam	CL-ML, CL, ML	A-4, A-6	0	100	100	90-100	70-90	25-35	5-12
	23-60	Very fine sandy loam, silt loam, loam.	SC, CL, CL-ML, SM-SC	A-2, A-4	0	100	100	60-100	30-90	20-30	5-10
590------------- Cairo	0-39	Silty clay, clay loam.	CH, CL	A-7	0	100	100	95-100	90-100	45-80	25-55
	39-73	Sandy loam, loamy very fine sand, fine sand.	SM, SC, SM-SC	A-2, A-4	0	100	65-100	50-80	15-45	15-30	NP-10
682------------- Medway	0-9	Silty clay loam	CL	A-6, A-7	0	100	100	90-100	85-95	30-45	10-20
	9-28	Loam, clay loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6, A-7	0	95-100	80-95	75-90	70-90	20-48	4-20
	28-60	Loam, very fine sandy loam, loamy fine sand, loamy very fine sand.	ML, CL, SM, SC	A-4, A-2	0	80-95	70-90	40-70	30-60	15-30	NP-10
787------------- Banlic	0-13	Silt loam--------	ML, CL, CL-ML	A-4	0	100	95-100	90-100	80-95	21-29	3-9
	13-22	Silt loam--------	ML, CL-ML, CL	A-4	0	100	95-100	90-100	80-95	22-32	3-10
	22-60	Silt loam, silt	ML, CL-ML, CL	A-4	0	100	95-100	90-100	80-95	22-32	3-10
801B*, 802D*. Orthents											
852E*: Alford-----------	0-9	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-100	25-40	5-15
	9-49	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	90-100	80-100	30-50	15-30
	49-66	Silt loam, silt	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-100	25-40	5-15
Wellston----------	0-13	Silt loam--------	ML	A-4	0	95-100	90-100	85-100	70-95	25-35	3-10
	13-39	Silt loam, silty clay loam.	CL, CL-ML	A-6, A-4	0-5	75-100	70-100	60-95	60-90	25-40	5-20
	39-62	Silt loam, loam, channery loam, channery silty clay loam.	CL-ML, CL, SC, SM-SC	A-4, A-6	0-20	65-90	65-90	60-90	40-65	20-35	5-15
864*. Pits											
930F*: Alford-----------	0-6	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-100	25-40	5-15
	6-92	Silt loam, silt	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-100	25-40	5-15

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
930F*:											
Goss	0-7	Silt loam	ML, CL, CL-ML	A-4	0-10	65-90	65-90	65-90	65-85	20-30	2-8
	7-48	Cherty silt loam, cherty silty clay loam.	GM, GC, GM-GC	A-2	10-40	40-60	35-55	30-50	25-35	20-30	2-8
	48-72	Cherty silty clay loam, cherty silty clay, cherty clay.	GC	A-7	10-45	45-70	40-65	40-50	35-45	50-70	30-40
930G*:											
Goss	0-10	Very cherty silt loam.	ML, CL, CL-ML	A-4	0-10	40-90	30-90	65-90	65-85	20-30	2-8
	10-27	Cherty silt loam, cherty silty clay loam.	GM, GC, GM-GC	A-2	10-40	40-60	15-55	30-50	25-35	20-30	2-8
	27-60	Cherty silty clay loam, cherty silty clay, cherty clay.	GC	A-7	10-45	45-70	40-65	40-50	35-45	50-70	30-40
Alford	0-6	Silt loam	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-100	25-40	5-15
	6-92	Silt loam, silt	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-100	25-40	5-15
940E*:											
Zanesville	0-10	Silt loam	CL-ML, CL, ML	A-4, A-6	0	95-100	95-100	90-100	80-100	25-40	4-15
	10-29	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	95-100	95-100	90-100	80-100	25-40	5-20
	29-53	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6	0-10	90-100	85-100	80-100	60-100	20-40	2-20
	53-65	Silty clay loam, clay loam, channery sandy clay loam.	SC, CL, SM, GM	A-6, A-4, A-2	0-25	65-100	50-95	40-95	20-85	20-40	2-20
Westmore	0-6	Silt loam	ML, CL-ML, CL	A-4	0	100	90-100	80-100	70-95	22-35	4-10
	6-20	Silty clay loam, silt loam.	CL, ML	A-6, A-7	0-5	95-100	90-100	85-100	80-90	30-50	11-20
	20-62	Clay, silty clay, silty clay loam.	CH, CL	A-7, A-6	0-15	80-100	65-95	60-90	55-90	38-70	18-40
954E*:											
Alford	0-9	Silt loam	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-100	25-40	5-15
	9-49	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	90-100	80-100	30-50	15-30
	49-60	Silt loam, silt	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-100	25-40	5-15
Baxter	0-15	Cherty silt loam, very cherty silt loam.	ML, CL, GM, GC	A-4, A-6	0-10	60-85	55-80	45-80	45-80	25-40	5-20
	15-43	Cherty silty clay loam, cherty silty clay, very cherty clay.	MH, CH, CL, GC	A-7	0-10	55-85	45-80	45-80	45-80	45-60	20-35
	43-70	Cherty clay, very cherty clay, cherty silty clay.	GC, GM, CH, MH	A-7	5-20	50-80	40-70	35-70	35-70	50-70	20-40

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
977F*:											
Wellston----------	0-9	Silt loam-------	ML	A-4	0	95-100	90-100	85-100	70-95	25-35	3-10
	9-30	Silt loam, silty clay loam.	CL, CL-ML	A-6, A-4	0-5	75-100	70-100	60-95	60-90	25-40	5-20
	30-60	Very channery silty clay loam, very channery loam.	CL-ML, CL, SC, SM-SC	A-4, A-6	15-90	65-90	65-90	60-90	40-65	20-35	5-15
Neotoma-----------	0-10	Stony silt loam	ML, GM, SM	A-4	10-30	55-80	50-75	40-70	40-65	22-35	3-10
	10-48	Very flaggy loam, flaggy silt loam, very channery loam.	GM	A-2, A-4	40-85	40-65	35-60	30-50	25-45	<35	NP-8
	48-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
1334--------------- Birds	0-6	Silt loam-------	CL	A-4, A-6	0	100	95-100	90-100	80-100	24-34	8-15
	6-60	Silt loam-------	CL	A-4, A-6	0	100	95-100	90-100	80-100	24-34	8-15
1426--------------- Karnak	0-8	Silty clay------	CH, CL, MH, ML	A-7	0	100	100	95-100	95-100	45-80	20-40
	8-60	Silty clay, clay	CH, MH, CL, ML	A-7	0	100	100	95-100	95-100	45-80	20-40
3071--------------- Darwin	0-27	Silty clay------	CH	A-7	0	100	100	100	95-100	50-85	30-55
	27-63	Silty clay loam, silty clay.	CL, CH	A-7, A-6	0	100	100	95-100	90-100	35-70	20-45
3092--------------- Sarpy	0-4	Loamy fine sand	SM	A-2	0	100	100	60-80	15-35	---	NP
	4-60	Loamy fine sand, fine sand.	SM	A-2	0	100	100	60-80	15-35	---	NP
3456--------------- Ware	0-16	Fine sandy loam	ML, CL-ML, CL	A-4	0	100	100	95-100	50-70	20-36	2-10
	16-60	Stratified silt loam to sand.	SM, ML, SM-SC, CL-ML	A-4, A-2	0	100	100	60-90	10-60	<25	NP-6
3590--------------- Cairo	0-32	Silty clay------	CH	A-7	0	100	100	95-100	90-100	51-80	31-55
	32-68	Stratified very fine sandy loam to silty clay loam.	CL, CL-ML, ML	A-7, A-6, A-4	0	100	100	85-100	50-100	15-50	8-30
3682--------------- Medway	0-27	Silty clay loam	CL	A-6, A-7	0	100	100	90-100	85-95	30-45	10-20
	27-35	Loam, silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6, A-7	0	95-100	80-95	75-90	70-90	20-48	4-20
	35-60	Loam, sandy loam, gravelly loam.	ML, CL, SM, SC	A-4, A-2	0	80-95	70-90	40-70	30-60	15-30	NP-10
4426--------------- Karnak	0-48	Clay------------	CH, CL, MH, ML	A-7	0	100	100	95-100	95-100	45-80	20-40
	48-60	Silty clay, clay	CH, MH, CL, ML	A-7	0	100	100	95-100	95-100	45-80	20-40
5308D*------------- Alford	0-7	Silt loam-------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-100	25-40	5-15
	7-43	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	90-100	80-100	30-50	15-30
	43-60	Silt loam, silt	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-100	25-40	5-15

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[The symbol < means less than; > means greater than. The erosion tolerance factor (T) is for the entire profile. Organic matter is for the surface layer. Absence of an entry means data were not available or were not estimated]

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Organic matter
	In	In/hr	In/in	pH				Pct
71-----------------	0-10	<0.06	0.11-0.14	6.1-7.8	High-----------	0.28	3	3-4
Darwin	10-62	<0.06	0.11-0.19	6.1-7.8	High-----------	0.28		
75C-----------------	0-6	0.6-2.0	0.22-0.24	5.6-7.3	Low------------	0.37	5	1-2
Drury	6-68	0.6-2.0	0.20-0.22	5.6-7.8	Low------------	0.37		
85-----------------	0-9	0.06-0.2	0.11-0.13	5.1-6.5	Very high------	0.28	3	1-2
Jacob	9-60	<0.06	0.09-0.13	3.6-5.5	Very high------	0.28		
92-----------------	0-14	>6.0	0.05-0.09	6.6-8.4	Low------------	0.15	5	0.5-1
Sarpy	14-60	>6.0	0.05-0.09	7.4-8.4	Low------------	0.15		
162-----------------	0-11	0.2-0.6	0.21-0.23	6.1-7.8	Moderate-------	0.32	5	3-4
Gorham	11-43	0.2-0.6	0.13-0.20	6.1-7.8	Moderate-------	0.32		
	43-60	2.0-20	0.05-0.13	6.1-7.8	Low------------	0.32		
164A-----------------	0-10	0.2-0.6	0.22-0.24	4.5-6.0	Low------------	0.43	3	1-2
Stoy	10-32	0.06-0.2	0.18-0.20	4.5-5.5	Moderate-------	0.43		
	32-50	0.06-0.2	0.09-0.12	4.5-5.5	Moderate-------	0.43		
	50-60	0.06-0.2	0.10-0.15	4.5-6.0	Low------------	0.43		
180-----------------	0-10	0.6-2.0	0.22-0.24	5.6-7.3	Low------------	0.37	5	1-2
Dupo	10-24	0.2-0.6	0.20-0.22	5.6-8.4	Low------------	0.37		
	24-65	0.06-0.2	0.08-0.19	6.6-7.8	High-----------	0.37		
214B, 214C2------	0-7	0.6-2.0	0.20-0.24	4.5-6.0	Low------------	0.43	4	1-2
Hosmer	7-28	0.6-2.0	0.18-0.22	4.5-5.5	Low------------	0.43		
	28-55	<0.06	0.06-0.08	4.5-5.0	Low------------	0.43		
	55-73	0.2-0.6	0.06-0.08	5.6-6.0	Low------------	0.43		
214C3-----------------	0-5	0.6-2.0	0.20-0.24	4.5-6.0	Low------------	0.43	3	0.5-1
Hosmer	5-12	0.6-2.0	0.18-0.22	4.5-5.5	Low------------	0.43		
	12-44	<0.06	0.06-0.08	4.5-5.0	Low------------	0.43		
	44-60	0.2-0.6	0.06-0.08	5.6-6.0	Low------------	0.43		
214D2-----------------	0-7	0.6-2.0	0.20-0.24	4.5-6.0	Low------------	0.43	4	1-2
Hosmer	7-28	0.6-2.0	0.18-0.22	4.5-5.5	Low------------	0.43		
	28-55	<0.06	0.06-0.08	4.5-5.0	Low------------	0.43		
	55-73	0.2-0.6	0.06-0.08	5.6-6.0	Low------------	0.43		
214D3-----------------	0-5	0.6-2.0	0.20-0.24	4.5-6.0	Low------------	0.43	3	0.5-1
Hosmer	5-12	0.6-2.0	0.18-0.22	4.5-5.5	Low------------	0.43		
	12-44	<0.06	0.06-0.08	4.5-5.0	Low------------	0.43		
	44-60	0.2-0.6	0.06-0.08	5.6-6.0	Low------------	0.43		
214E-----------------	0-7	0.6-2.0	0.20-0.24	4.5-6.0	Low------------	0.43	4	1-2
Hosmer	7-28	0.6-2.0	0.18-0.22	4.5-5.5	Low------------	0.43		
	28-55	<0.06	0.06-0.08	4.5-5.0	Low------------	0.43		
	55-73	0.2-0.6	0.06-0.08	5.6-6.0	Low------------	0.43		
214E3-----------------	0-5	0.6-2.0	0.20-0.24	4.5-6.0	Low------------	0.43	3	0.5-1
Hosmer	5-12	0.6-2.0	0.18-0.22	4.5-5.5	Low------------	0.43		
	12-44	<0.06	0.06-0.08	4.5-5.0	Low------------	0.43		
	44-60	0.2-0.6	0.06-0.08	5.6-6.0	Low------------	0.43		
284A-----------------	0-11	0.6-2.0	0.21-0.23	6.1-7.8	Moderate-------	0.32	5	2-3
Tice	11-60	0.6-2.0	0.15-0.20	6.1-7.8	Moderate-------	0.32		
308B2, 308C2------	0-8	0.6-2.0	0.22-0.24	5.1-7.3	Low------------	0.37	5	1-2
Alford	8-48	0.6-2.0	0.18-0.20	4.5-6.5	Moderate-------	0.37		
	48-70	0.6-2.0	0.20-0.22	4.5-7.3	Low------------	0.37		
308C3-----------------	0-3	0.6-2.0	0.21-0.23	4.5-6.5	Moderate-------	0.37	4	0.5-1
Alford	3-45	0.6-2.0	0.18-0.20	4.5-6.5	Moderate-------	0.37		
	45-60	0.6-2.0	0.20-0.22	4.5-7.3	Low------------	0.37		

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Organic matter
	In	In/hr	In/in	pH				Pct
308D2------------ Alford	0-8	0.6-2.0	0.22-0.24	5.1-7.3	Low------------	0.37	5	1-2
	0-48	0.6-2.0	0.18-0.20	4.5-6.5	Moderate-------	0.37		
	48-70	0.6-2.0	0.20-0.22	4.5-7.3	Low------------	0.37		
308D3------------ Alford	0-3	0.6-2.0	0.21-0.23	4.5-6.5	Moderate-------	0.37	4	0.5-1
	3-45	0.6-2.0	0.18-0.20	4.5-6.5	Moderate-------	0.37		
	45-60	0.6-2.0	0.20-0.22	4.5-7.3	Low------------	0.37		
308E------------- Alford	0-8	0.6-2.0	0.22-0.24	5.1-7.3	Low------------	0.37	5	1-2
	8-48	0.6-2.0	0.18-0.20	4.5-6.5	Moderate-------	0.37		
	48-70	0.6-2.0	0.20-0.22	4.5-7.3	Low------------	0.37		
308E3------------ Alford	0-3	0.6-2.0	0.21-0.23	4.5-6.5	Moderate-------	0.37	4	0.5-1
	3-45	0.6-2.0	0.18-0.20	4.5-6.5	Moderate-------	0.37		
	45-60	0.6-2.0	0.20-0.22	4.5-7.3	Low------------	0.37		
331-------------- Haymond	0-20	0.6-2.0	0.22-0.24	5.6-7.3	Low------------	0.37	5	1-2
	20-62	0.6-2.0	0.20-0.22	5.6-7.3	Low------------	0.37		
333-------------- Wakeland	0-7	0.6-2.0	0.22-0.24	6.6-7.3	Low------------	0.37	5	1-2
	7-60	0.6-2.0	0.20-0.22	6.6-7.3	Low------------	0.37		
334-------------- Birds	0-11	0.2-0.6	0.22-0.24	5.6-7.8	Low------------	0.43	5	1-2
	11-60	0.2-0.6	0.20-0.22	5.1-7.8	Low------------	0.43		
420-------------- Piopolis	0-7	0.06-0.2	0.21-0.23	5.1-5.5	Moderate-------	0.43	4	1-2
	7-45	0.06-0.2	0.18-0.20	5.1-5.5	Moderate-------	0.43		
	45-60	0.06-0.2	0.18-0.20	6.6-7.3	Moderate-------	0.43		
422-------------- Cape	0-12	0.06-0.2	0.18-0.21	4.5-7.3	Moderate-------	0.32	3	1-2
	12-47	<0.06	0.10-0.13	3.6-5.5	High-----------	0.32		
	47-60	0.06-0.2	0.15-0.20	3.6-5.5	Moderate-------	0.32		
426-------------- Karnak	0-6	0.06-0.2	0.11-0.14	5.6-6.0	High-----------	0.32	3	1-2
	6-75	<0.2	0.09-0.13	5.6-7.3	High-----------	0.32		
427-------------- Burnside	0-14	0.6-2.0	0.22-0.24	4.5-6.0	Low------------	0.37	4	1-2
	14-63	0.6-2.0	0.10-0.16	4.5-5.5	Low------------	0.37		
	63-69	---	---	---	---------------	---		
456-------------- Ware	0-21	0.6-2.0	0.16-0.24	5.6-8.4	Low------------	0.28	3	2-3
	21-60	2.0-6.0	0.07-0.19	6.1-7.8	Very low-------	0.24		
475-------------- Elsah	0-15	0.6-2.0	0.17-0.24	5.6-7.3	Low------------	0.24	4	1-2
	15-40	2.0-6.0	0.10-0.15	5.6-7.3	Low------------	0.17		
	40-60	2.0-6.0	0.06-0.11	5.6-7.3	Low------------	0.17		
589-------------- Bowdre	0-17	0.06-0.2	0.15-0.20	5.6-7.3	High-----------	0.37	3	2-3
	17-23	0.2-0.6	0.19-0.22	6.1-8.4	Low------------	0.32		
	23-60	0.6-2.0	0.15-0.22	6.1-8.4	Low------------	0.32		
590-------------- Cairo	0-39	<0.06	0.09-0.17	6.1-7.8	High-----------	0.28	4	3-4
	39-73	6.0-20	0.08-0.18	6.1-7.8	Low------------	0.17		
682-------------- Medway	0-9	0.6-2.0	0.16-0.20	6.1-8.4	Low------------	0.32	5	3-5
	9-28	0.6-2.0	0.14-0.18	6.1-8.4	Low------------	---		
	28-60	0.6-2.0	0.08-0.15	6.6-8.4	Low------------	---		
787-------------- Banlic	0-13	0.2-0.6	0.22-0.24	4.5-6.5	Low------------	0.43	3	1-2
	13-22	0.06-0.2	0.20-0.22	4.5-6.0	Low------------	0.43		
	22-60	0.06-0.2	0.11-0.12	4.5-6.0	Low------------	0.43		
801B*, 802D*. Orthents								
852E*:								
Alford----------	0-9	0.6-2.0	0.22-0.24	5.1-7.3	Low------------	0.37	5	1-2
	9-49	0.6-2.0	0.18-0.20	4.5-6.5	Moderate-------	0.37		
	49-66	0.6-2.0	0.20-0.22	4.5-7.3	Low------------	0.37		

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Organic matter
	In	In/hr	In/in	pH				Pct
852E*:								
Wellston--------	0-13	0.6-2.0	0.18-0.22	5.1-6.5	Low------------	0.37	4	1-2
	13-39	0.6-2.0	0.17-0.21	4.5-6.0	Low------------	0.37		
	39-62	0.6-2.0	0.08-0.15	4.5-6.0	Low------------	0.37		
864*. Pits								
930F*:								
Alford----------	0-6	0.6-2.0	0.22-0.24	5.1-7.3	Low------------	0.37	5	1-2
	6-92	0.6-2.0	0.20-0.22	4.5-7.3	Low------------	0.37		
Goss------------	0-7	2.0-6.0	0.06-0.17	5.1-6.0	Low------------	0.24	2	1-2
	7-48	2.0-6.0	0.06-0.10	5.1-6.0	Low------------	0.24		
	48-72	0.6-2.0	0.04-0.09	5.1-6.0	Moderate-------	0.24		
930G*:								
Goss------------	0-10	2.0-6.0	0.06-0.17	5.1-6.0	Low------------	0.24	2	1-2
	10-27	2.0-6.0	0.06-0.10	5.1-6.0	Low------------	0.24		
	27-60	0.6-2.0	0.04-0.09	5.1-6.0	Moderate-------	0.24		
Alford----------	0-6	0.6-2.0	0.22-0.24	5.1-7.3	Low------------	0.37	5	1-2
	6-92	0.6-2.0	0.20-0.22	4.5-7.3	Low------------	0.37		
940E*:								
Zanesville------	0-10	0.6-2.0	0.19-0.23	4.5-5.5	Low------------	0.37	3	1-2
	10-29	0.6-2.0	0.17-0.22	4.5-5.5	Low------------	0.37		
	29-53	0.06-0.6	0.08-0.12	4.5-6.0	Low------------	0.37		
	53-65	0.2-2.0	0.08-0.12	4.5-7.3	Low------------	0.28		
Westmore--------	0-6	0.6-2.0	0.17-0.21	5.1-6.0	Low------------	0.37	4	1-2
	6-20	0.6-2.0	0.15-0.19	5.1-6.0	Moderate-------	0.37		
	20-62	0.2-0.6	0.12-0.16	4.5-7.8	High-----------	0.37		
954E*:								
Alford----------	0-9	0.6-2.0	0.22-0.24	5.1-7.3	Low------------	0.37	5	1-2
	9-49	0.6-2.0	0.18-0.20	4.5-6.5	Moderate-------	0.37		
	49-60	0.6-2.0	0.20-0.22	4.5-7.3	Low------------	0.37		
Baxter----------	0-15	0.6-2.0	0.14-0.18	3.6-6.0	Low------------	0.32	4	1-2
	15-43	0.6-2.0	0.10-0.14	3.6-5.5	Moderate-------	0.24		
	43-70	0.6-2.0	0.08-0.13	3.6-5.5	Moderate-------	0.24		
977F*:								
Wellston--------	0-9	0.6-2.0	0.18-0.22	5.1-6.5	Low------------	0.37	4	1-2
	9-30	0.6-2.0	0.17-0.21	4.5-6.0	Low------------	0.37		
	30-60	0.6-2.0	0.06-0.09	4.5-6.0	Low------------	0.37		
Neotoma---------	0-10	0.6-6.0	0.14-0.20	5.6-6.5	Low------------	0.20	3	1-2
	10-48	2.0-6.0	0.05-0.09	5.1-6.5	Low------------	0.20		
	48-60	---	---	---	---------------	---		
1334------------- Birds	0-6	0.2-0.6	0.22-0.24	5.6-7.8	Low------------	0.43	5	1-2
	6-60	0.2-0.6	0.20-0.22	5.1-7.8	Low------------	0.43		
1426------------- Karnak	0-8	0.06-0.2	0.11-0.14	5.6-6.0	High-----------	0.32	5	1-2
	8-60	<0.2	0.09-0.13	5.6-7.3	High-----------	0.32		
3071------------- Darwin	0-27	<0.06	0.11-0.14	6.1-7.8	High-----------	0.28	3	3-4
	27-63	0.06-0.2	0.10-0.20	7.4-8.4	High-----------	0.28		
3092------------- Sarpy	0-4	>6.0	0.05-0.09	6.6-8.4	Low------------	0.15	5	0.5-1
	4-60	>6.0	0.05-0.09	7.4-8.4	Low------------	0.15		
3456------------- Ware	0-16	0.6-2.0	0.20-0.24	5.6-8.4	Low------------	0.28	3	2-3
	.6-60	2.0-20.0	0.07-0.19	6.1-7.8	Very low-------	0.24		

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Organic matter
	In	In/hr	In/in	pH				Pct
3590-------------- Cairo	0-32	<0.06	0.11-0.14	7.4-7.8	High-----------	0.28	4	3-4
	32-68	0.2-2.0	0.15-0.20	7.9-8.4	Low-------------	0.28		
3682-------------- Medway	0-27	0.6-2.0	0.16-0.20	6.1-8.4	Low-------------	0.32	5	3-5
	27-35	0.6-2.0	0.14-0.18	6.1-8.4	Low-------------	---		
	35-60	0.6-2.0	0.08-0.15	6.6-8.4	Low-------------	---		
4426-------------- Karnak	0-48	0.06-0.2	0.11-0.14	5.6-6.0	High-----------	0.32	5	5-7
	48-60	<0.2	0.09-0.13	5.6-7.3	High-----------	0.32		
5308D*------------ Alford	0-7	0.6-2.0	0.22-0.24	5.1-7.3	Low-------------	0.37	5	1-2
	7-43	0.6-2.0	0.18-0.20	4.5-6.5	Moderate--------	0.37		
	43-60	0.6-2.0	0.20-0.22	4.5-7.3	Low-------------	0.37		

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--SOIL AND WATER FEATURES

[The definitions of "flooding" and "water table" in the Glossary explain terms such as "rare," "brief," "
The symbol < means less than; > means more than. Absence of an entry indicates that the feature is

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Pote fr act
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	
					Ft			In		
71 Darwin	D	Rare	---	---	0-2.0	Apparent	Jan-Jun	>60	---	Mode
75C Drury	B	None	---	---	>6.0	---	---	>60	---	High
85 Jacob	D	Rare	---	---	0-1.0	Perched	Feb-Jul	>60	---	Mode
92 Sarpy	A	Rare	---	---	>6.0	---	---	>60	---	Low-
162 Gorham	B/D	Frequent	Brief	Mar-Jun	0-3.0	Apparent	Mar-Jun	>60	---	High
164A Stoy	D	None	---	---	1.0-3.0	Perched	Feb-Apr	>60	---	High
180 Dupo	C	Rare	---	---	1.0-3.0	Apparent	Jan-Jun	>60	---	High
214B, 214C2, 214C3, 214D2, 214D3, 214E, 214E3 Hosmer	C	None	---	---	3.0-6.0	Perched	Mar-Apr	>60	---	High
284A Tice	C	Rare	---	---	1.0-3.0	Apparent	Mar-Jun	>60	---	High
308B2, 308C2, 308C3, 308D2, 308D3, 308E, 308E3 Alford	B	None	---	---	>6.0	---	---	>60	---	High
331 Haymond	B	Rare	---	---	>6.0	---	---	>60	---	High
333 Wakeland	B/D	Frequent	Brief	Jan-May	1.0-3.0	Apparent	Jan-Apr	>60	---	High
334 Birds	C/D	Frequent	Long	Mar-Jun	0-1.0	Apparent	Mar-Jun	>60	---	High
420 Piopolis	C/D	Frequent	Long	Mar-Jun	0-3.0	Apparent	Mar-Jun	>60	---	High
422 Cape	D	Rare	---	---	0-1.0	Perched	Mar-Jul	>60	---	High

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Pot fr act
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	
					Ft			In		
426-------------- Karnak	D	Rare--------	---	---	0-3.0	Apparent	Apr-Jun	>60	---	Hig
427-------------- Burnside	B	Occasional	Brief-----	Mar-Jun	3.0-5.0	Apparent	Feb-Jun	29-65	Hard	Mod
456-------------- Ware	B	Rare--------	---	---	4.0-6.0	Apparent	Apr-Jun	>60	---	Mod
475-------------- Elsah	B	Frequent----	Brief-----	Dec-May	>6.0	---	---	>60	---	Mod
589-------------- Bowdre	C	Rare--------	---	---	1.5-2.0	Perched	Jan-Apr	>60	---	-
590-------------- Cairo	D	Common------	Brief-----	Nov-Jun	0-2.0	Apparent	Nov-Jun	>60	---	Mod
682-------------- Medway	B	Common------	Very brief	Nov-Jun	1.5-3.0	Apparent	Jan-Apr	>60	---	Hig
787-------------- Banlic	C	Rare--------	---	---	1.0-3.0	Perched	Jan-Jun	>60	---	Hig
801B*, 802D*. Orthents										
852E*:										
Alford-----------	B	None--------	---	---	>6.0	---	---	>60	---	Hig
Wellston---------	B	None--------	---	---	>6.0	---	---	>40	Hard	Hig
864*. Pits										
930F*:										
Alford-----------	B	None--------	---	---	>6.0	---	---	>60	---	Hig
Goss-------------	B	None--------	---	---	>6.0	---	---	>60	---	Mod
930G*:										
Goss-------------	B	None--------	---	---	>6.0	---	---	>60	---	Mod
Alford-----------	B	None--------	---	---	>6.0	---	---	>60	---	Hig
940E*:										
Zanesville-------	C	None--------	---	---	2.0-3.0	Perched	Dec-Apr	40-80	Hard	-
Westmore---------	B	None--------	---	---	>6.0	---	---	>48	Hard	Hig
954E*:										
Alford-----------	B	None--------	---	---	>6.0	---	---	>60	---	Hig
Baxter-----------	B	None--------	---	---	>6.0	---	---	>60	---	-

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Pote fr act
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	
					Ft			In		
977F*:										
Wellston	B	None	---	---	>6.0	---	---	>40	Hard	High
Neotoma	B	None	---	---	>6.0	---	---	40-80	Hard	Low-
1334 Birds	C/D	Frequent	Long	Mar-Jun	0-1.0	Apparent	Mar-Jun	>60	---	High
1426 Karnak	D	Frequent	Long	Mar-May	0-3.0	Apparent	Apr-Jun	>60	---	High
3071 Darwin	D	Frequent	Long	Jan-Jun	0-2.0	Apparent	Jan-Jun	>60	---	Mode
3092 Sarpy	A	Frequent	Brief to long.	Nov-Jun	>6.0	---	---	>60	---	Low-
3456 Ware	B	Common	Brief	Oct-Jun	4.0-6.0	Apparent	Apr-Jun	>60	---	Mode
3590 Cairo	D	Frequent	Long	Nov-Jun	0-2.0	Apparent	Nov-Jun	>60	---	Mode
3682 Medway	B	Common	Very brief	Nov-Jun	1.5-3.0	Apparent	Jan-Apr	>60	---	High
4426 Karnak	D	Frequent	Long	Mar-May	0-3.0	Apparent	Apr-Jun	>60	---	High
5308D* Alford	B	None	---	---	>6.0	---	---	>60	---	High

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--ENGINEERING TEST DATA

Soil name and location	Parent material	Report number 75-IL-091	Depth	Moisture density: Maximum dry density	Moisture density: Optimum moisture	Percentage passing sieve--: No. 4	No. 10	No. 40	No. 200	Percentage smaller than--: 0.05 mm	0.02 mm	0.005 mm	0.00 mm
			In	lb/cu ft	Pct								
Birds silt loam: Union County, 840 feet east and 810 feet south of the northwest corner of SW1/4 sec. 9, T. 12 S., R. 1 E.	Silty alluvium	3-1	0-60	104.4	17.4	100	99.7	97.9	96.3	89.3	54.4	21.0	15.5
Bowdre silty clay: Union County, 200 feet south and 335 feet east of the northwest corner of sec. 24, T. 11 S., R. 4 W. (Modal)	Alluvium.	6-1	5-10	98.6	19.0	100	100	100	99.5	95.5	84.2	52.6	40.0
		6-2	23-42	104.2	18.6	100	100	100	80.9	69.5	32.6	14.6	13.6
Gorham silty clay loam: Union County, 1,920 feet north and 1,540 feet east of the southwest corner of sec. 5, T. 12 S., R. 3 W. (Modal)	Alluvium.	9-1	11-19	96.7	22.5	100	100	100	96.2	93.4	74.2	50.2	41.3
		9-2	26-39	102.7	19.5	100	100	100	80.1	74.2	58.3	34.6	27.5
		9-3	52-60	98.3	17.0	100	100	99.9	2.5	1.3	1.2	1.1	1.0
Haymond silt loam: Union County, 1,220 feet west and 600 feet north of the southeast corner of sec. 1, T. 11 S., R. 2 W.	Silty alluvium	4-1	0-60	107.4	15.8	100	99.9	99.4	89.5	79.7	31.6	12.6	9.2

TABLE 17.--ENGINEERING TEST DATA--Continued

Soil name and location	Parent material	Report number 75-IL-091	Depth	Moisture density: Maximum dry density	Moisture density: Optimum moisture	Percentage passing sieve--: No. 4	No. 10	No. 40	No. 200	Percentage smaller than--: 0.05 mm	0.02 mm	0.005 mm	0.00 mm
			In	lb/cu ft	Pct								
Hosmer silt loam: Union County, 1,200 feet north and 400 feet west of the southeast corner SW1/4 sec. 16, T. 11 S., R. 1 E. (Modal)	Loess.	5-1	7-18	102.5	20.1	100	100	99.3	97.6	91.2	64.3	30.2	22.9
		5-2	28-41	101.1	21.0	100	100	99.5	98.1	92.9	62.3	30.2	25.8
Jacob silty clay: Union County, 100 feet west and 700 feet south of the center of sec. 33, T. 11 S., R. 3 W. (Modal)	Clay.	1-1	0-60	85.2	30.5	100	100	99.8	98.9	97.2	90.2	68.6	62.3
Medway silty clay loam: Union County, 320 feet west and 740 feet south of the northeast corner of sec. 8, T. 12 S., R. 3 W. (Modal)	Alluvium.	8-1	9-19	104.6	19.1	100	100	100	80.0	72.5	52.6	30.6	24.8
		8-2	28-36	103.8	15.0	100	100	100	15.5	14.8	8.4	5.1	4.9
		8-3	45-58	96.7	17.0	100	100	99.9	5.0	3.2	2.0	1.1	1.0
Tice silty clay loam: Union County, 460 feet west and 40 feet south of the center of sec. 10, T. 12 S., R. 3 W. (Modal)	Loamy alluvium	10-1	14-24	101.7	18.4	100	100	99.9	75.3	45.4	32.7	25.0	23.5
		10-2	37-48	100.6	19.8	100	100	99.9	81.2	66.3	53.5	38.6	34.3

TABLE 17.--ENGINEERING TEST DATA--Continued

Soil name and location	Parent material	Report number 75-IL-091	Depth	Moisture density: Maximum dry density	Moisture density: Optimum moisture	Percentage passing sieve--: No. 4	No. 10	No. 40	No. 200	Percentage smaller than--: 0.05 mm	0.02 mm	0.005 mm	0.002 mm
			In	lb/cu ft	Pct								
Wakeland silt loam: Union County, 1,550 feet east and 1,550 feet north of the southwest corner of fractional sec. 7, T. 12 S., R. 1 E. (Modal)	Silty alluvium	2-1	0-60	104.5	18.0	100	100	99.8	98.6	91.7	78.4	26.6	19.5
Ware loam: Union County, 2,400 feet west and 250 feet south of the northeast corner of sec. 16, T. 12 S., R. 3 W. (Modal)	Loamy alluvium	7-1	12-21	101.6	17.7	100	100	100	59.1	37.4	14.6	9.0	8.1
		7-2	21-28	98.9	18.2	100	100	100	45.5	28.4	9.6	5.5	4.9
		7-3	48-55	104.9	15.8	100	100	97.1	7.0	6.2	4.1	1.3	1.2

TABLE 18.--CLASSIFICATION OF THE SOILS

[An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series]

Soil name	Family or higher taxonomic class
Alford	Fine-silty, mixed, mesic Typic Hapludalfs
Banlic	Coarse-silty, mixed, nonacid, mesic Aeric Haplaquepts
Baxter	Fine, mixed, mesic Typic Paleudalfs
Birds	Fine-silty, mixed, nonacid, mesic Typic Fluvaquents
Bowdre	Clayey over loamy, montmorillonitic, thermic Fluvaquentic Hapludolls
Burnside	Loamy-skeletal, mixed, acid, mesic Typic Udifluvents
*Cairo	Clayey over sandy or sandy-skeletal, montmorillonitic, thermic Vertic Haplaquolls
Cape	Fine, montmorillonitic, acid, mesic Typic Fluvaquents
Darwin	Fine, montmorillonitic, mesic Vertic Haplaquolls
Drury	Fine-silty, mixed, mesic Dystric Eutrochrepts
Dupo	Coarse-silty over clayey, mixed, nonacid, mesic Aquic Udifluvents
Elsah	Loamy-skeletal, mixed, nonacid, mesic Typic Udifluvents
Gorham	Fine-silty, mixed, mesic Fluvaquentic Haplaquolls
Goss	Clayey-skeletal, mixed, mesic Typic Paleudalfs
Haymond	Coarse-silty, mixed, nonacid, mesic Typic Udifluvents
Hosmer	Fine-silty, mixed, mesic Typic Fragiudalfs
Jacob	Very-fine, montmorillonitic, acid, mesic Vertic Haplaquepts
Karnak	Fine, montmorillonitic, nonacid, mesic Vertic Haplaquepts
Medway	Fine-loamy, mixed, mesic Fluvaquentic Hapludolls
Neotoma	Loamy-skeletal, mixed, mesic Ultic Hapludalfs
Piopolis	Fine-silty, mixed, acid, mesic Typic Fluvaquents
*Sarpy	Mixed, mesic Typic Udipsamments
Stoy	Fine-silty, mixed, mesic Aquic Hapludalfs
Tice	Fine-silty, mixed, mesic Fluvaquentic Hapludolls
Wakeland	Coarse-silty, mixed, nonacid, mesic Aeric Fluvaquents
Ware	Coarse-loamy, mixed, thermic Fluventic Hapludolls
Wellston	Fine-silty, mixed, mesic Ultic Hapludalfs
Westmore	Fine-silty, mixed, mesic Typic Hapludalfs
Zanesville	Fine-silty, mixed, mesic Typic Fragiudalfs

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U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
FOREST SERVICE

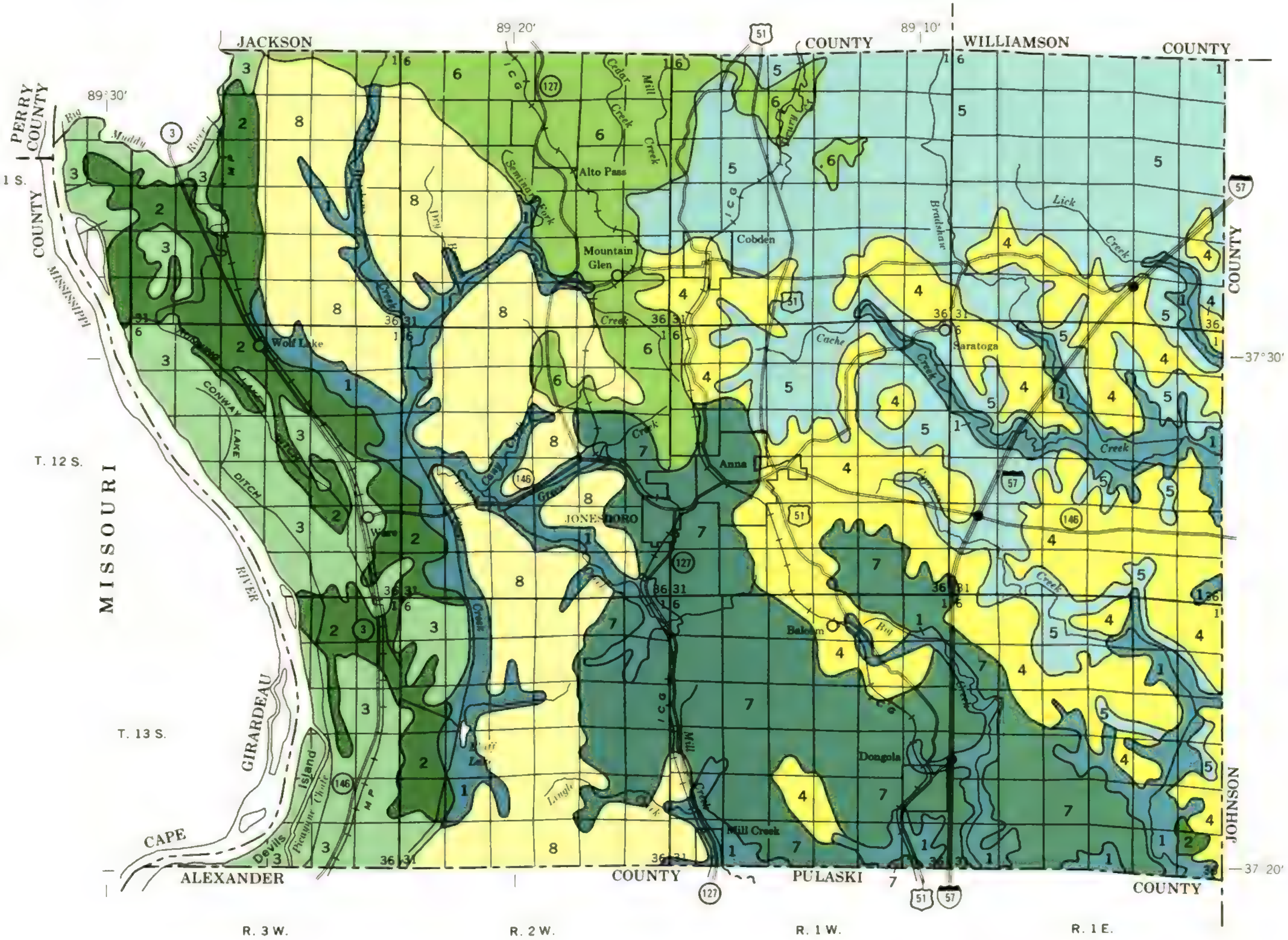
ILLINOIS AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

UNION COUNTY, ILLINOIS

Scale 1:190,080

1 0 1 2 3 4 Miles



SOIL LEGEND

1 — Wakeland–Haymond association: Nearly level, somewhat poorly drained and well drained soils formed in silty alluvial deposits

2 — Karnak–Darwin–Jacob association: Nearly level, poorly drained or very poorly drained soils formed in clayey alluvial deposits

3 — Ware–Medway association: Nearly level and gently sloping, moderately well drained soils formed in silty, loamy, and sandy alluvial deposits

4 — Hosmer association: Gently sloping to moderately steep, moderately well drained soils that have a fragipan and that formed in loess

5 — Hosmer–Zanesville association: Gently sloping to moderately steep, moderately well drained soils that have a fragipan and that formed in loess or in loess and material weathered from sandstone and siltstone

6 — Alford–Wellston association: Gently sloping to steep, well drained soils formed in loess or in loess and material weathered from sandstone and siltstone

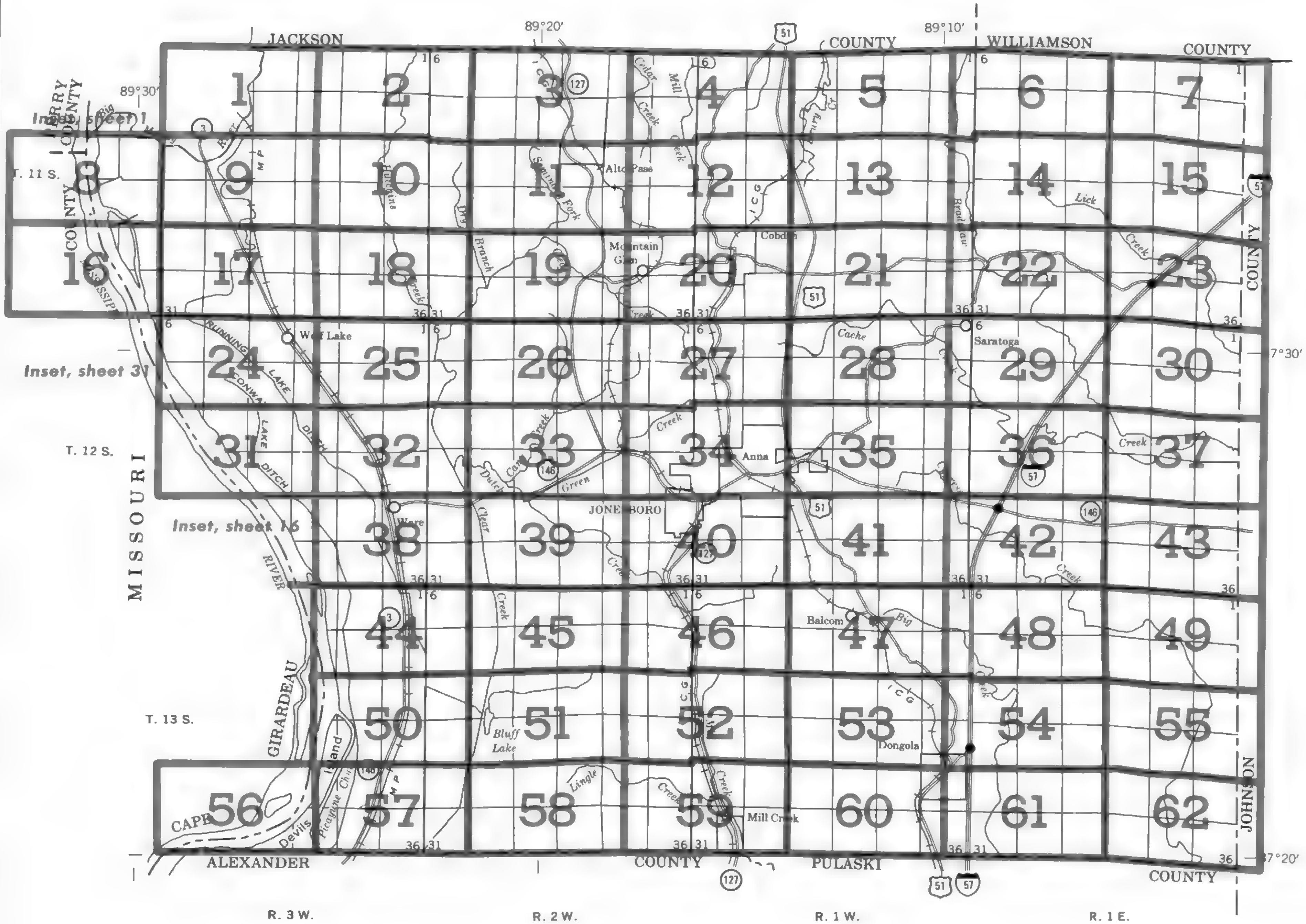
7 — Alford association: Gently sloping to moderately steep, well drained soils formed in loess

8 — Goss–Alford association: Moderately steep to very steep, well drained soils formed in material weathered from cherty limestone or in loess

Compiled 1978

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36



INDEX TO MAP SHEETS

UNION COUNTY, ILLINOIS

Scale 1:190,080

1 0 1 2 3 4 Miles

N

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield, cemetery, or flood pool — Davis Airstrip; FLOOD POOL LINE

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEMS & DESIGNATIONS

- Interstate — 79
- Federal — 410
- State — 52
- County, farm or ranch — 378

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small — water

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) — Indian Mound
- Located object (label) — Tower
- Tank (label) — GAS
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) — CANAL
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial — water
- Intermittent — int

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS — 71 214C2

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

DEPRESSION OR SINK

SOIL SAMPLE SITE (normally not shown) — S

MISCELLANEOUS

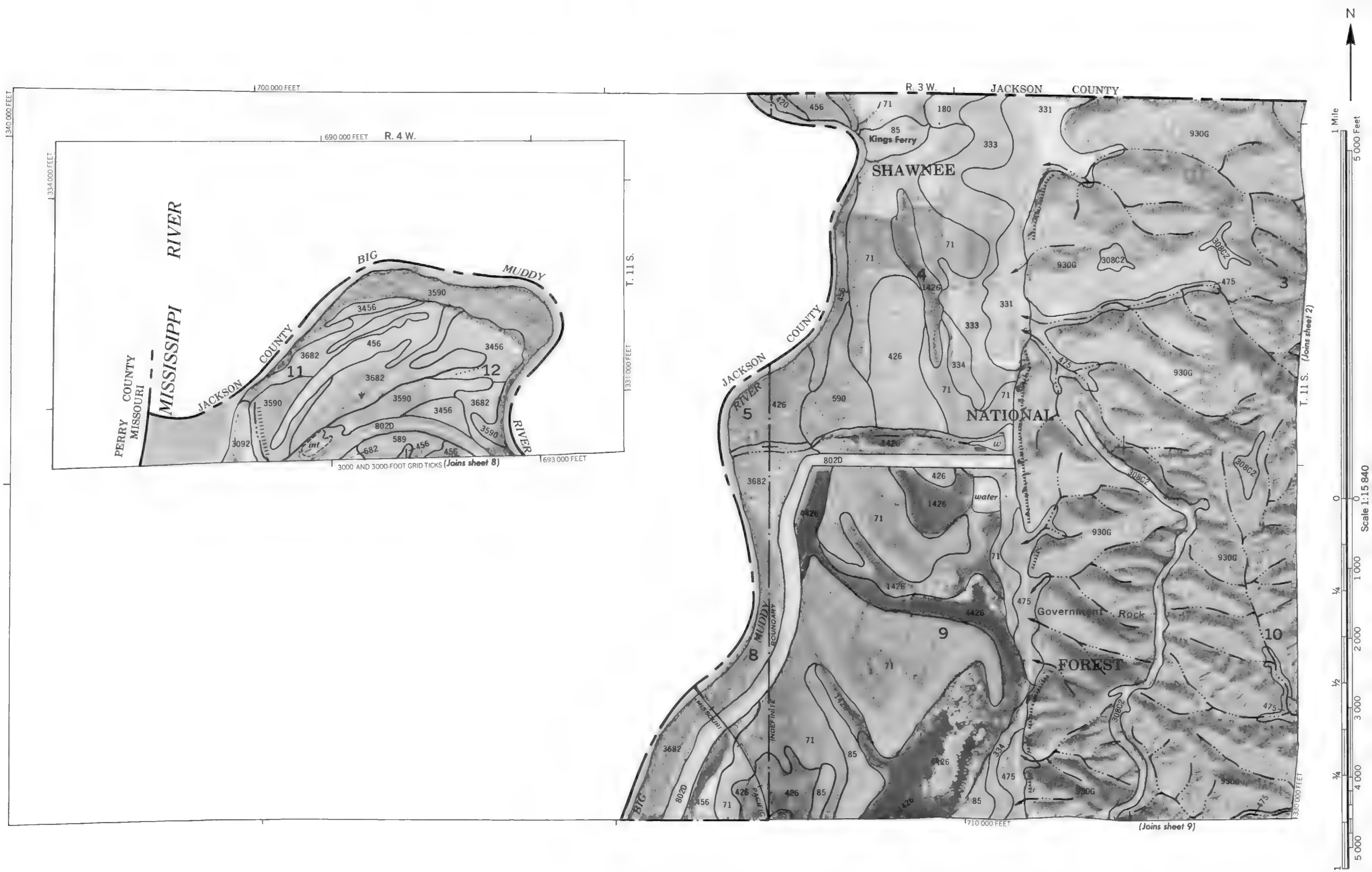
- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot
- Spot of silty alluvial soil in depressions
- Sewage lagoon — S.L.

SOIL LEGEND

Numerical symbols alone or preceding a capital letter represent the soil. The capital letter indicates the slope class. Symbols without a slope letter are for nearly level or nearly level and gently sloping soils or for miscellaneous areas. A final number 2 or 3 after the slope letter in the symbol indicates that the soil is eroded or severely eroded.

SYMBOL	NAME
71	Darwin silty clay
75C	Drury silt loam, 3 to 10 percent slopes
[illegible]	Jacob silty clay
92	Sarpy loamy fine sand
162	Gorham silty clay loam
164A	Stoy silt loam, 0 to 3 percent slopes
180	Dupo silt loam
214B	Hosmer silt loam, 2 to 6 percent slopes
214C2	Hosmer silt loam, 6 to 12 percent slopes, eroded
214C3	Hosmer silty clay loam, 6 to 12 percent slopes, severely eroded
214D2	Hosmer silt loam, 12 to 18 percent slopes, eroded
214D3	Hosmer silty clay loam, 12 to 18 percent slopes, severely eroded
214E	Hosmer silt loam, 18 to 30 percent slopes
214E3	Hosmer silty clay loam, 18 to 30 percent slopes, severely eroded
284A	Tice silty clay loam, 0 to 3 percent slopes
308B2	Alford silt loam, 2 to 6 percent slopes, eroded
308C2	Alford silt loam, 6 to 12 percent slopes, eroded
308C3	Alford silty clay loam, 6 to 12 percent slopes, severely eroded
308D2	Alford silt loam, 12 to 18 percent slopes, eroded
308D3	Alford silty clay loam, 12 to 18 percent slopes, severely eroded
308E	Alford silt loam, 18 to 30 percent slopes
308E3	Alford silty clay loam, 18 to 30 percent slopes, severely eroded
331	Haymond silt loam
333	Wakeland silt loam
334	Birds silt loam
420	Piopolis silty clay loam
422	Cape silty clay loam
426	Karnak silty clay
427	Burnside loam
456	Ware loam
475	Elsah silt loam
589	Bowdre silty clay
590	Cairo silty clay
682	Medway silty clay loam
787	Banlic silt loam
801B	Orthents, silty, 1 to 5 percent slopes
802D	Orthents, loamy, 2 to 20 percent slopes
852E	Alford—Wellston silt loams, 15 to 30 percent slopes
864	Pits, quarry, limestone
930F	Alford—Goss complex, 20 to 35 percent slopes
930G	Goss—Alford complex, 30 to 70 percent slopes
940E	Zanesville—Westmore silt loams, 15 to 30 percent slopes
954E	Alford—Baxter complex, 15 to 30 percent slopes
977F	Wellston—Neotoma complex, 20 to 35 percent slopes
1334	Birds silt loam, wet
1426	Karnak silty clay, wet
3071	Darwin silty clay, frequently flooded
3092	Sarpy fine sand, frequently flooded
3456	Ware fine sandy loam, frequently flooded
3590	Cairo silty clay, frequently flooded
3682	Medway silty clay loam, frequently flooded
4426	Karnak clay, ponded
5308D	Alford soils, karst, 2 to 20 percent slopes

1



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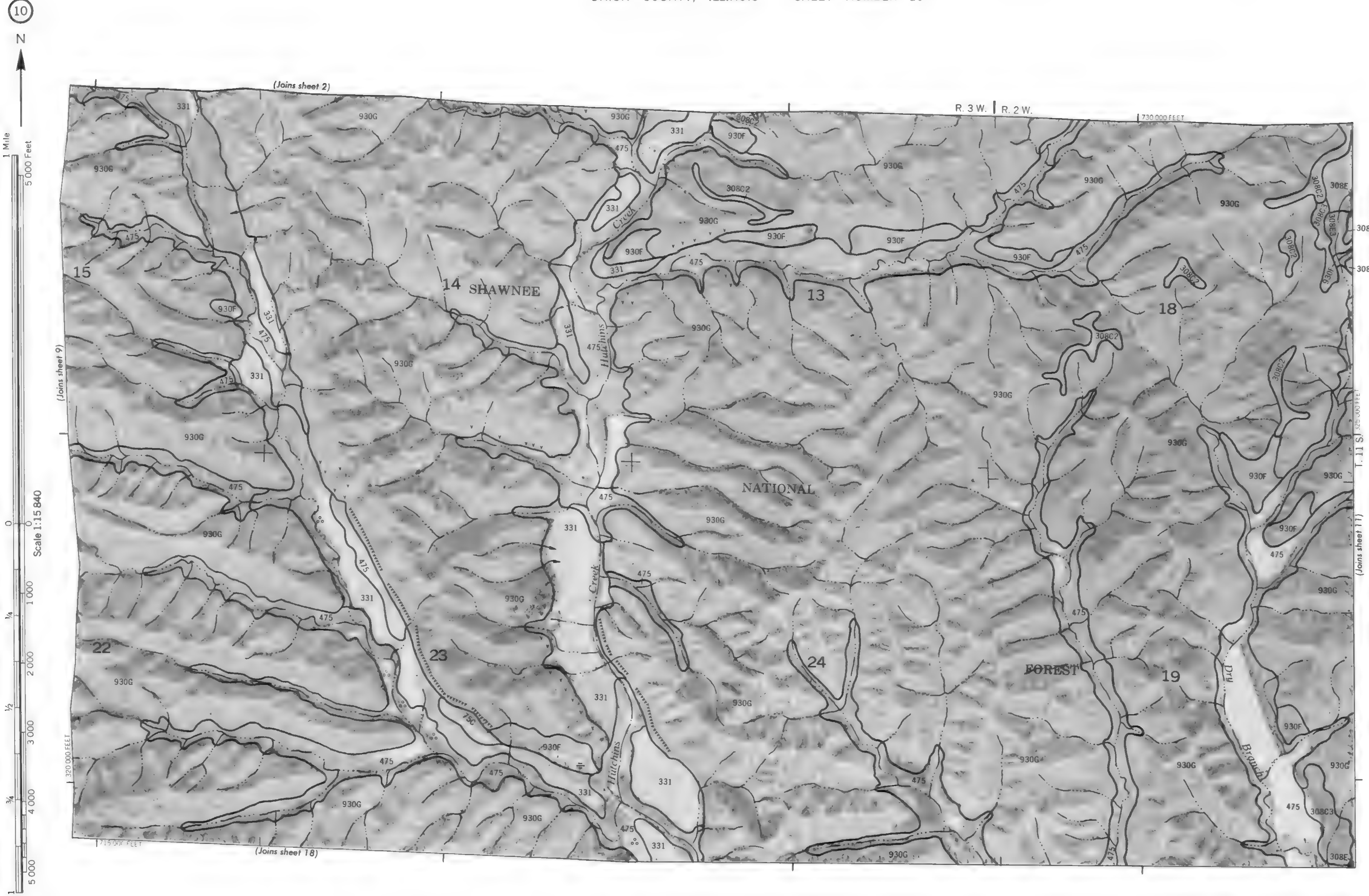
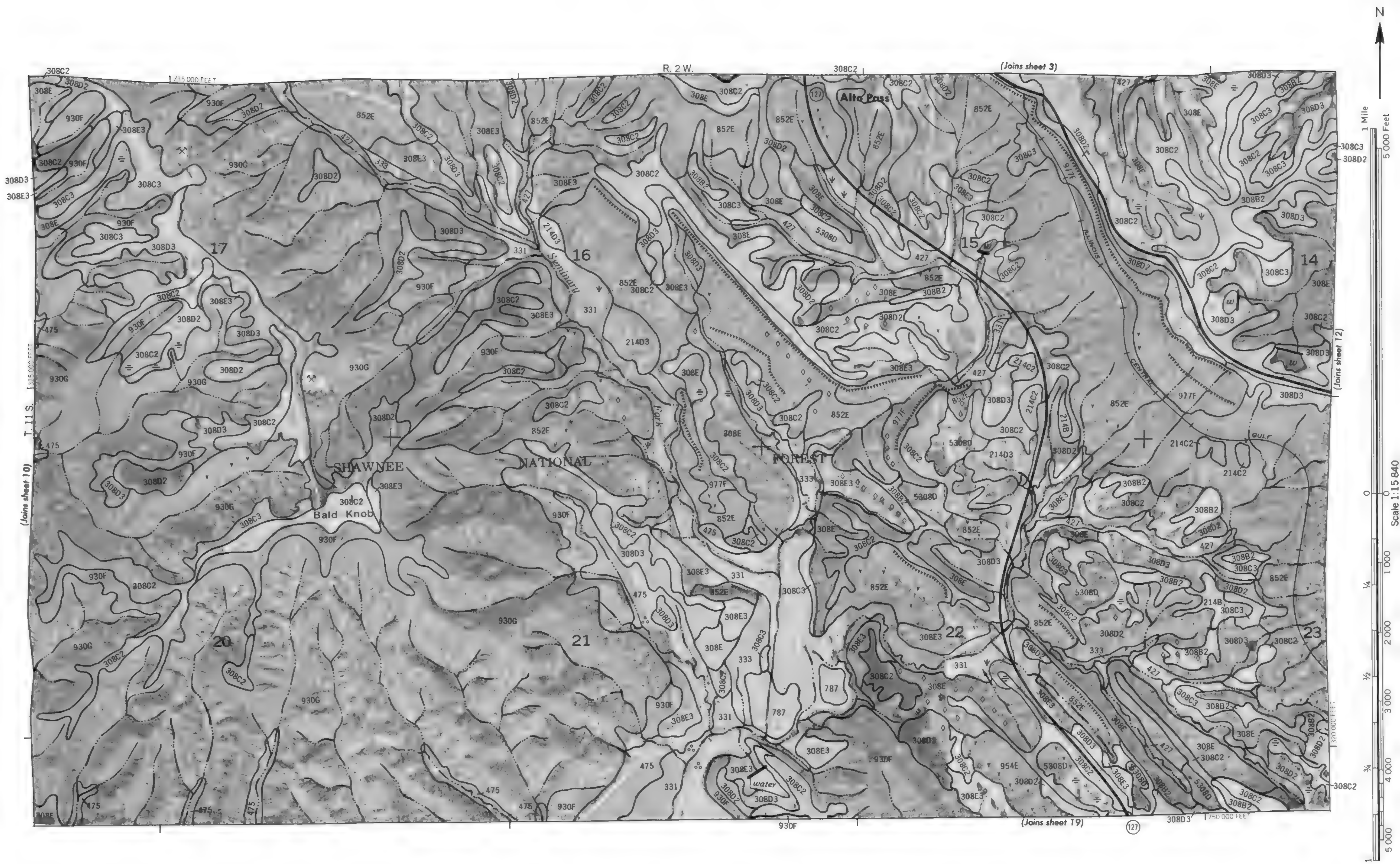


This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service [illegible] cooperating agencies
Coordinate grid ticks and land division corners, if shown, are approximately positioned



This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

UNION COUNTY, ILLINOIS — SHEET NUMBER 12

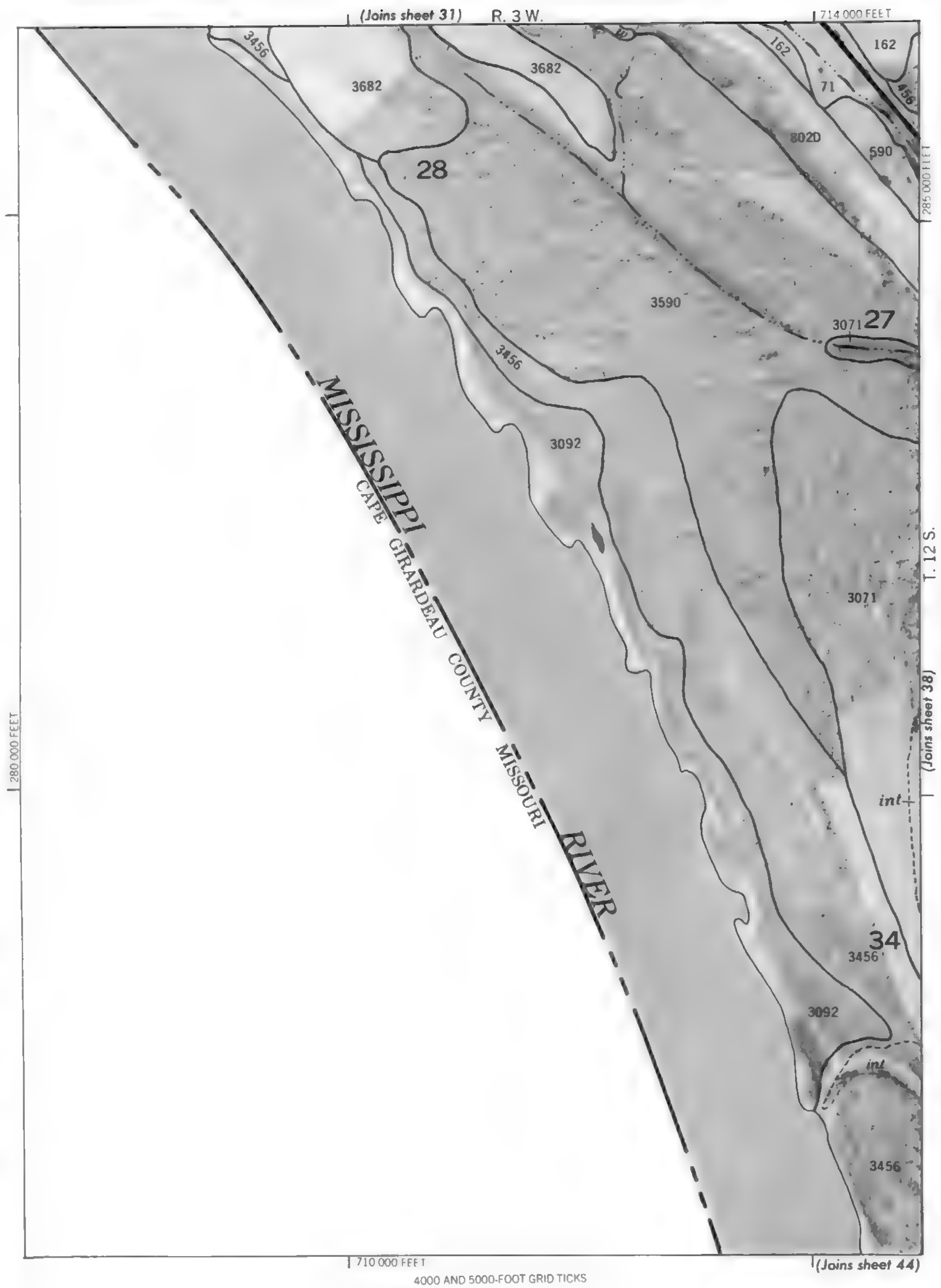
This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

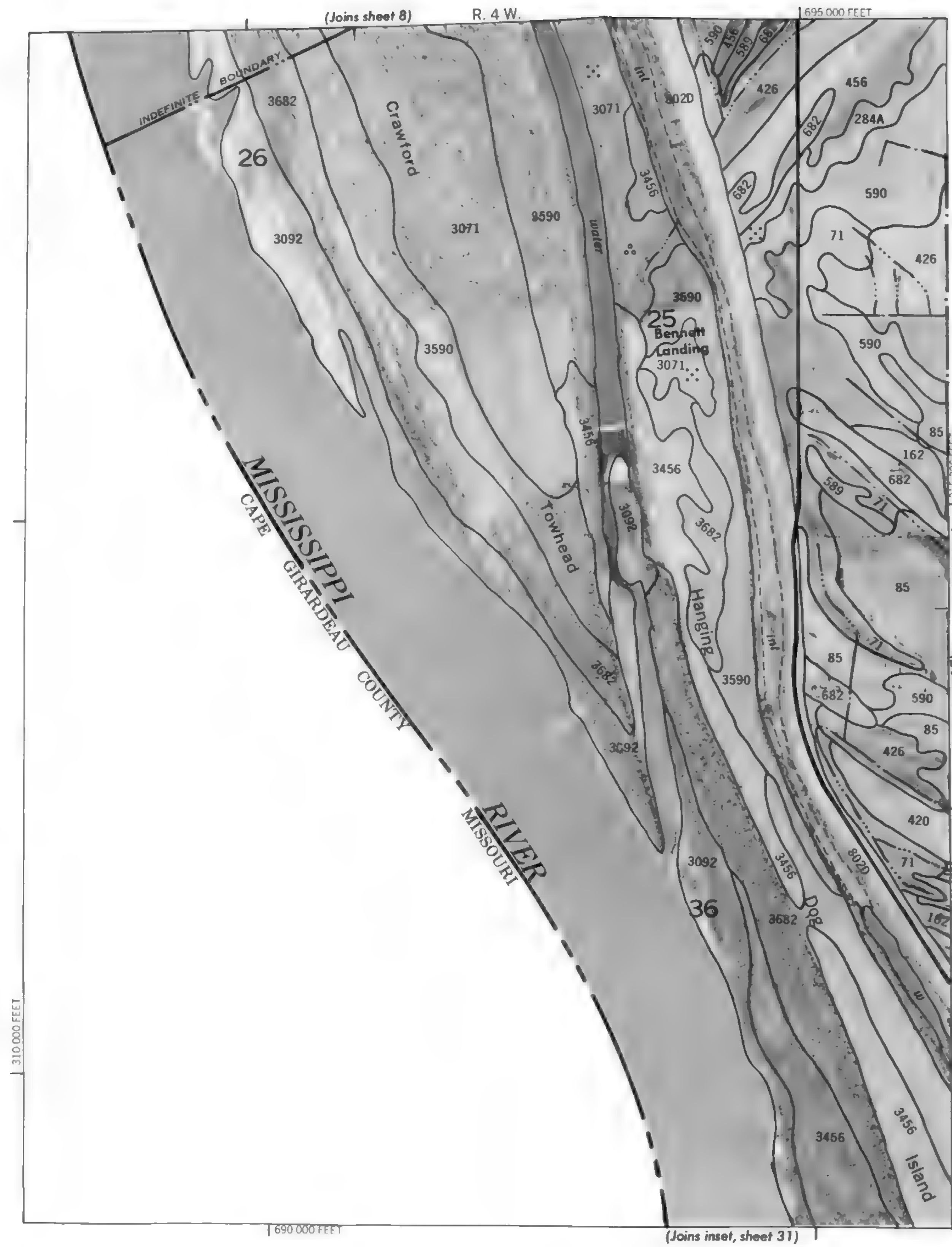

N
R. 1 W.
T. 11 S.
(Joins sheet 5)
(Joins sheet 12)
(Joins sheet 14)
(Joins sheet 21)
775 000 FEET
790 000 FEET
330 000 FEET
320 000 FEET
SHAWNEE
NATIONAL
FOREST
Drury Creek
Bradshaw Creek
Water Valley
ILLINOIS CENTRAL GULF
INDEFINITE BOUNDARY
51
16
15
14
13
21
22
23
24
1 Mile
5 000 Feet
Scale 1:15 840

UNION COUNTY, ILLINOIS — SHEET NUMBER 14

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

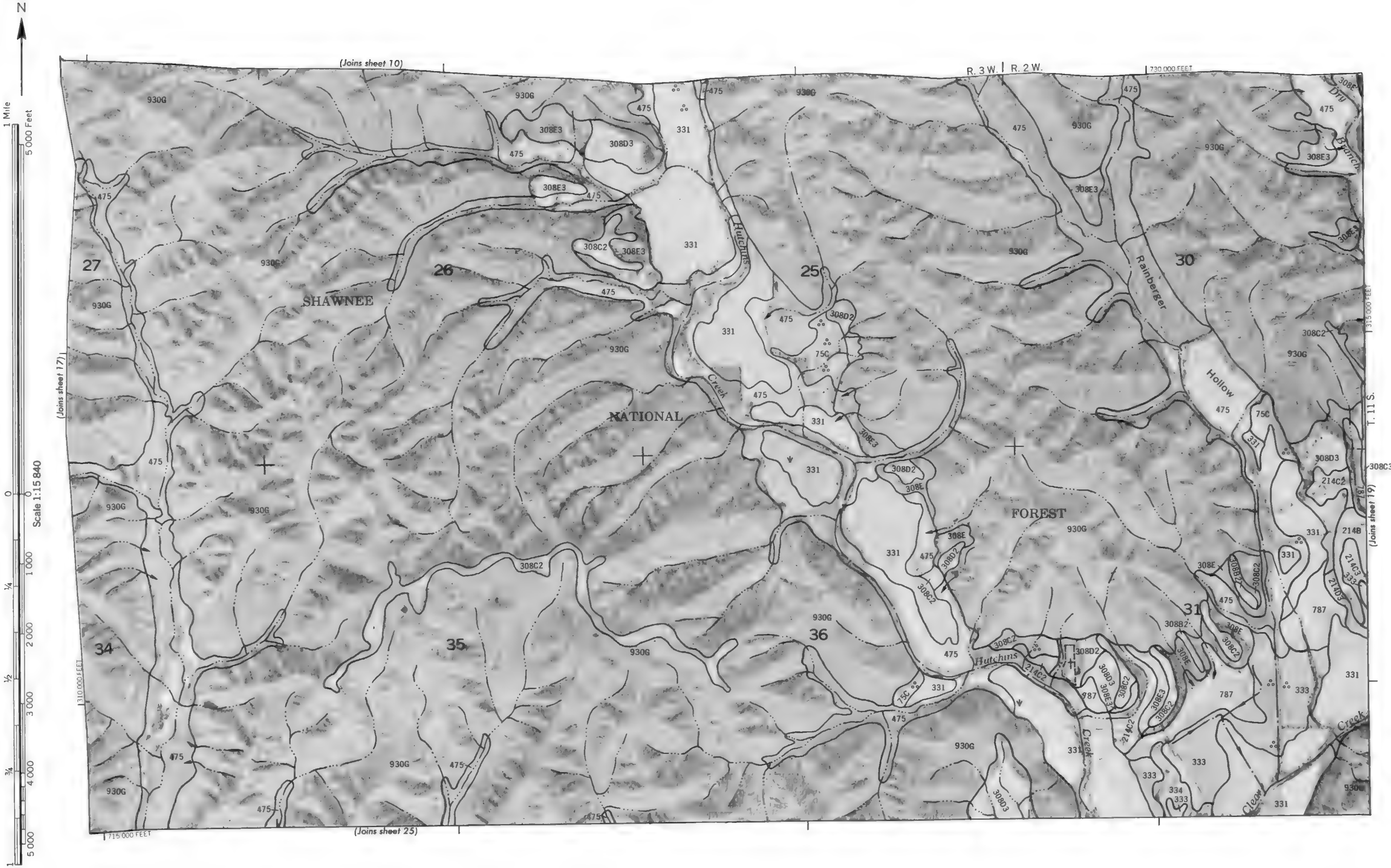
This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



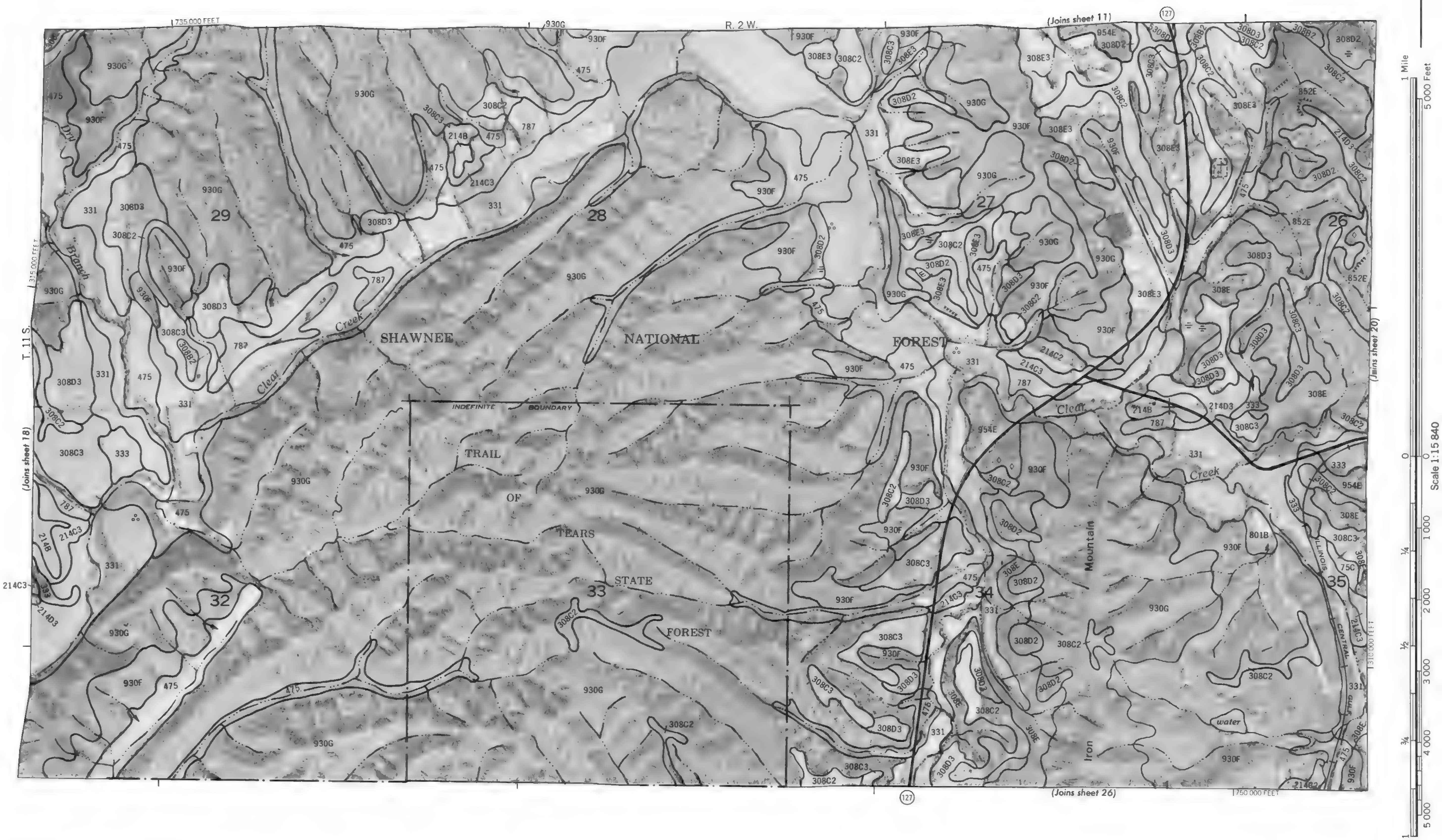


This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned

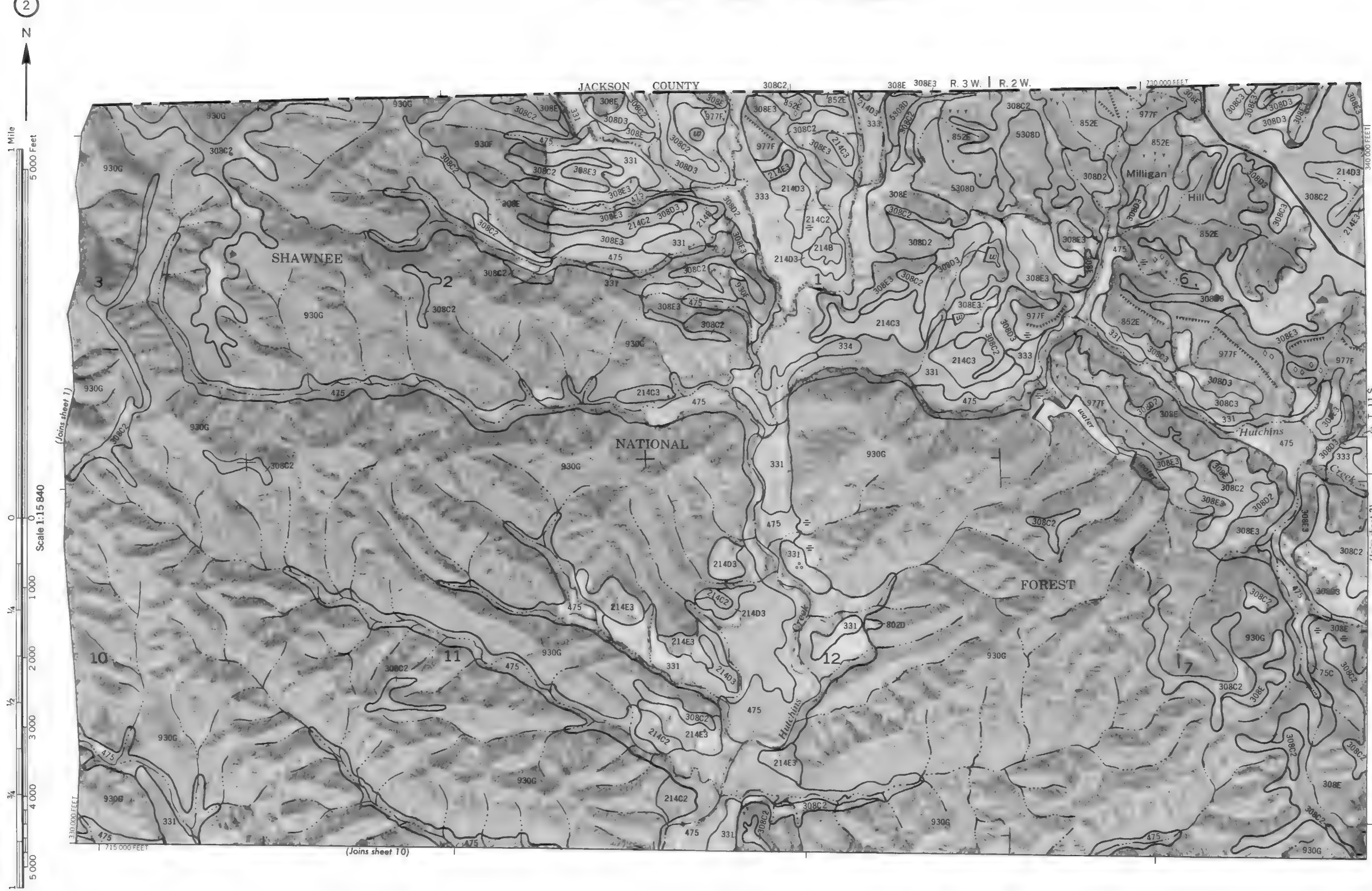
This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



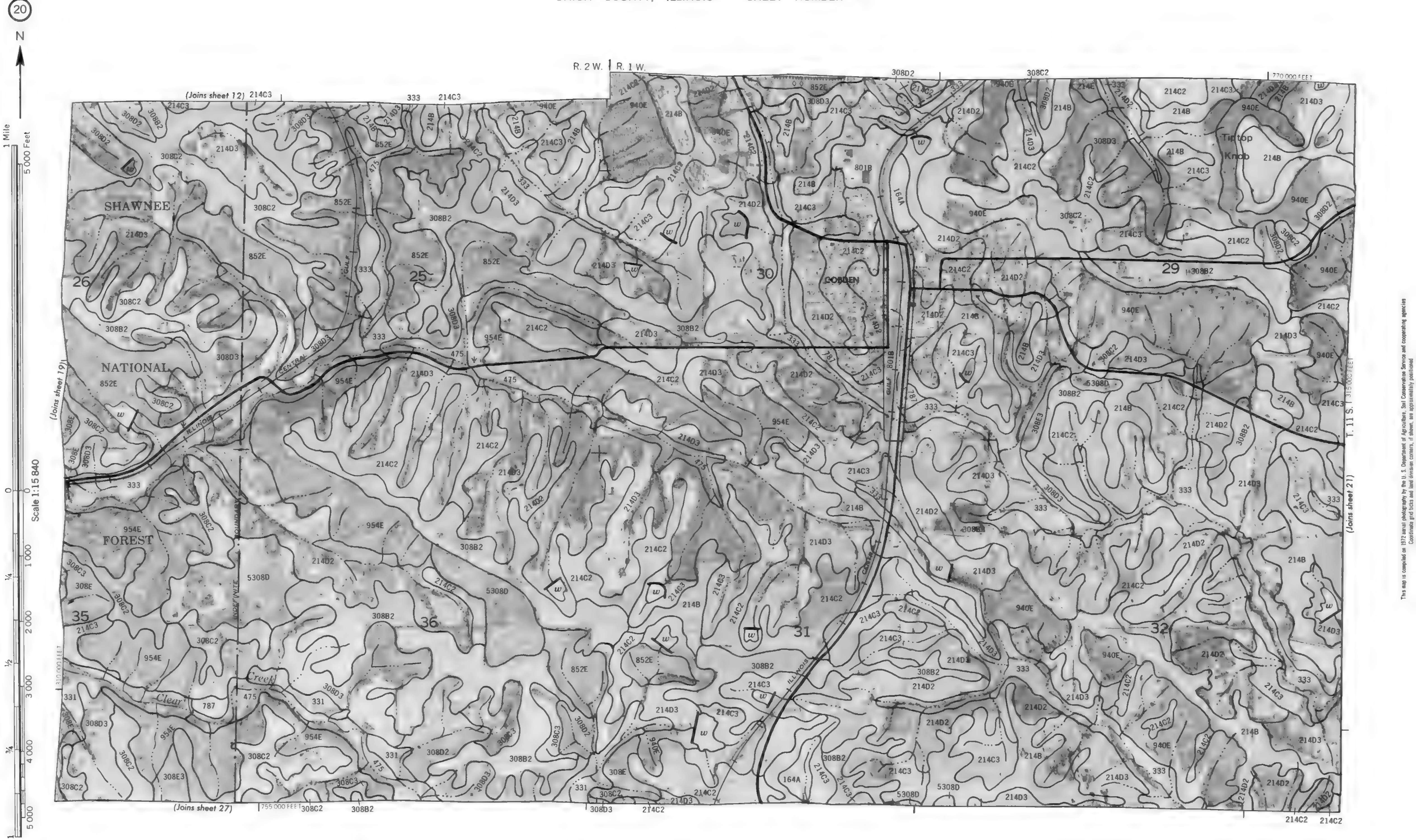
This [illegible] is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners, if shown, are approximately positioned



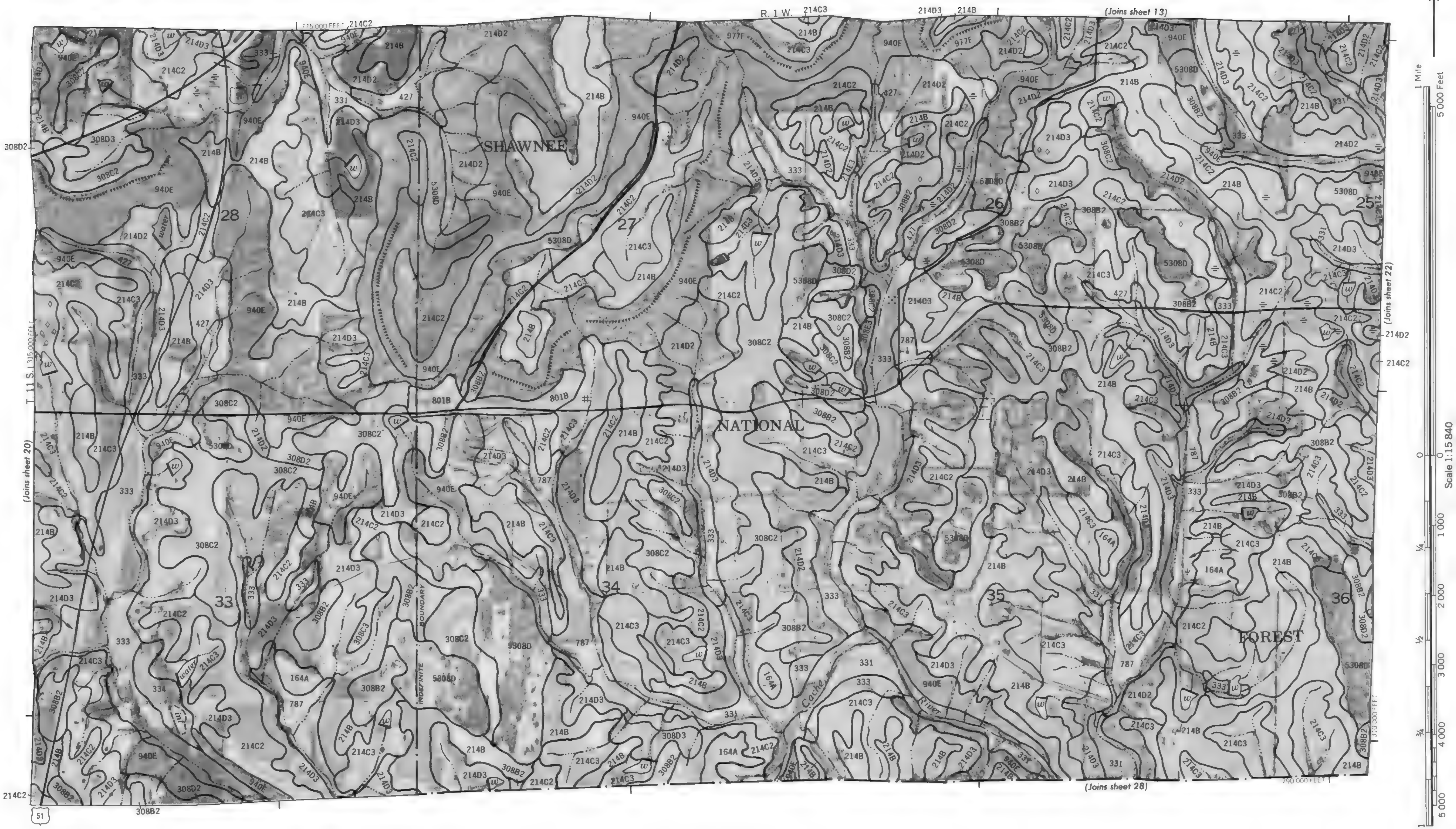
This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

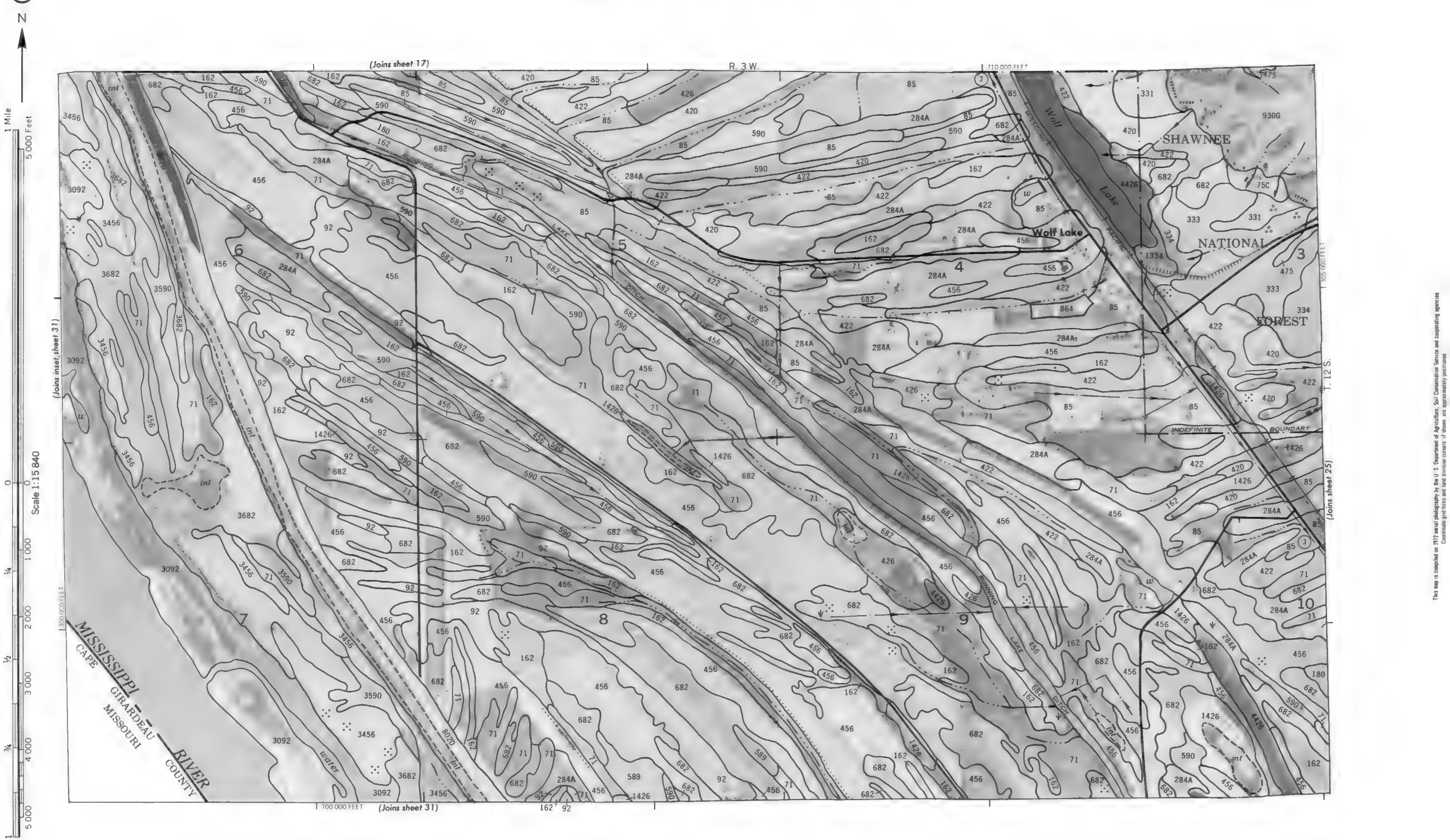

20
N
1 Mile
5 000 Feet
Scale 1:15 840
R. 2 W. | R. 1 W.
(Joins sheet 12)
(Joins sheet 19)
(Joins sheet 21)
(Joins sheet 27)
T. 11 S.
770 000 FEET
755 000 FEET
310 000 FEET
315 000 FEET
SHAWNEE
NATIONAL
FOREST
COBDEN
Tiptop Knob
Clear Creek
ILLINOIS CENTRAL GULF
INDEFINITE BOUNDARY
25
26
29
30
31
32
35
36
214B
214C2
214C3
214D2
214D3
308B2
308C2
308C3
308D2
308D3
308E
308E3
331
333
475
787
801B
852E
940E
954E
164A
5308D
w
This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

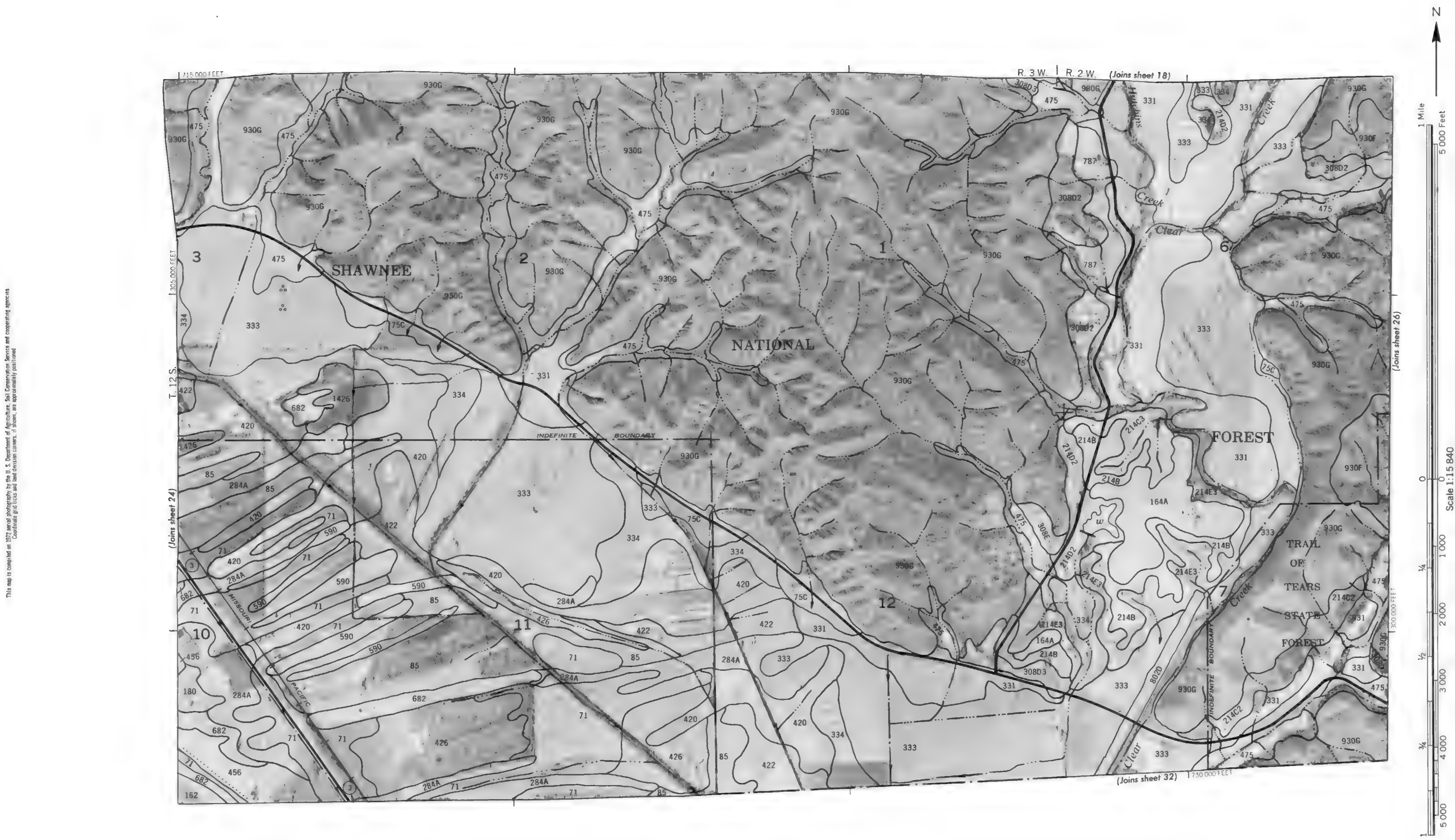
This map is compiled on 1972 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

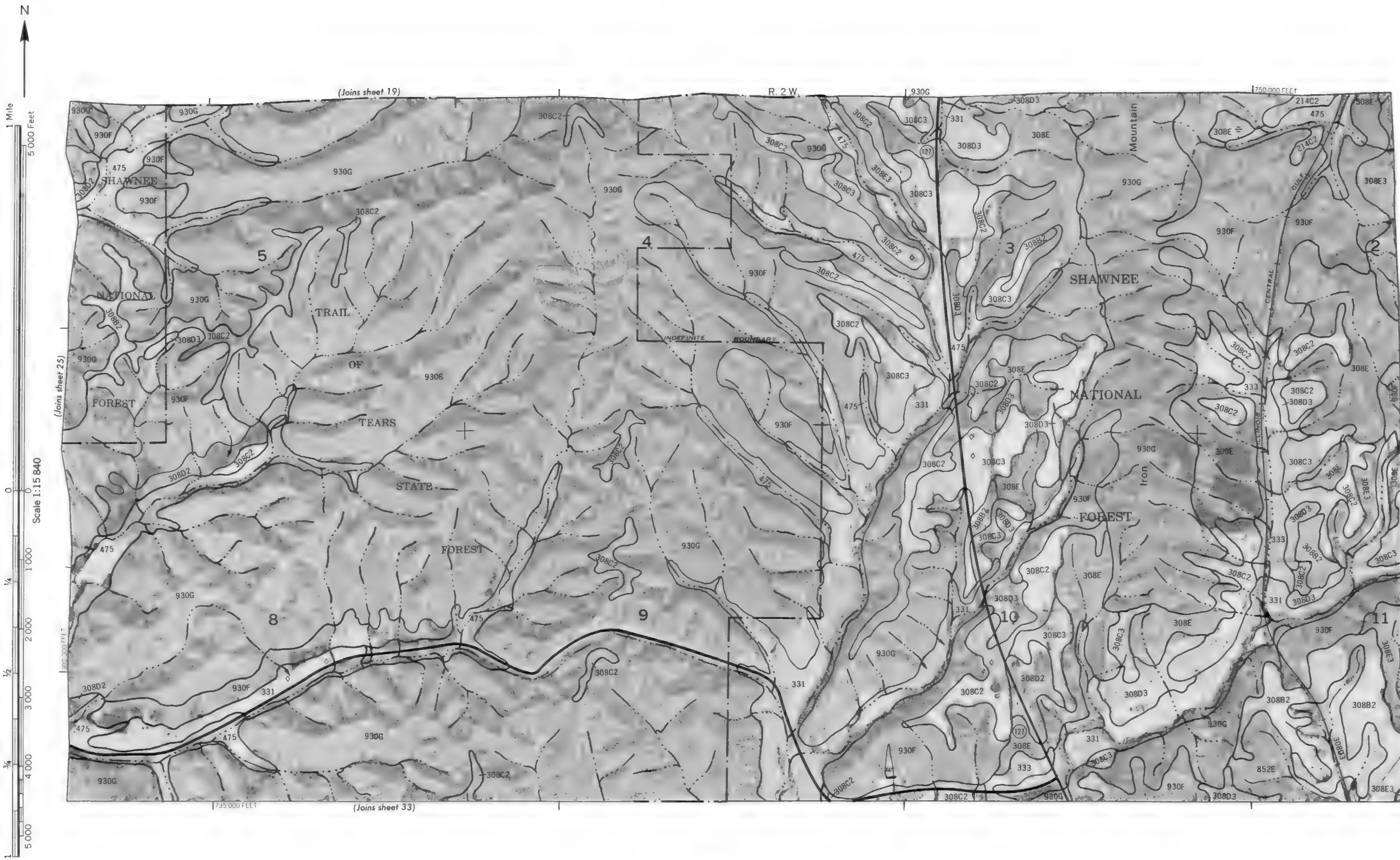


This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.


N
R. 1 E.
T. 11 S.
(Joins sheet 15)
(Joins sheet 22)
(Joins sheet 30)
810 000 FEET
320 000 FEET
310 000 FEET
825 000 FEET
SHAWNEE
NATIONAL
FOREST
Buck Knob
Chimney Rock
Drapers Bluff
Lick Creek
JOHNSON COUNTY
water
INDEFINITE BOUNDARY
57
25
26
27
34
35
36
1 Mile
5 000 Feet
Scale 1:15 840


24
N
(Joins sheet 17)
R. 3 W.
710 000 FEET
Wolf Lake
SHAWNEE
NATIONAL
FOREST
T. 12 S.
305 000 FEET
INDEFINITE
BOUNDARY
(Joins sheet 25)
(Joins inset, sheet 31)
300 000 FEET
700 000 FEET
(Joins sheet 31)
RUNNING
LAKE
DITCH
MISSOURI
PACIFIC
MISSISSIPPI
RIVER
CAPE
GIRARDEAU
COUNTY
MISSOURI
water
1 Mile
5 000 Feet
Scale 1:15 840


25
N
(Joins sheet 18)
R. 3 W.
R. 2 W.
T. 12 S.
(Joins sheet 24)
(Joins sheet 26)
(Joins sheet 32)
SHAWNEE
NATIONAL
FOREST
TRAIL OF TEARS STATE FOREST
INDEFINITE BOUNDARY
MISSOURI
PACIFIC
Clear Creek
Hutchins Creek
715 000 FEET
730 000 FEET
305 000 FEET
300 000 FEET
1 Mile
5 000 Feet
Scale 1:15 840
This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners, if shown, are approximately positioned


N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 19)
(Joins sheet 25)
(Joins sheet 27)
(Joins sheet 33)
R. 2 W.
T. 12 S.
750 000 FEET
735 000 FEET
SHAWNEE
NATIONAL
FOREST
TRAIL
OF
TEARS
STATE
FOREST
INDEFINITE BOUNDARY
Mountain
Iron
GULF
CENTRAL
ILLINOIS
127
5
4
3
2
8
9
10
11
930G
930F
475
308D2
308B2
308D3
308C2
308C3
308E
308E3
308B2
214C2
331
333
852E

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

UNION COUNTY, ILLINOIS — SHEET NUMBER 28

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners, if shown, are approximately positioned

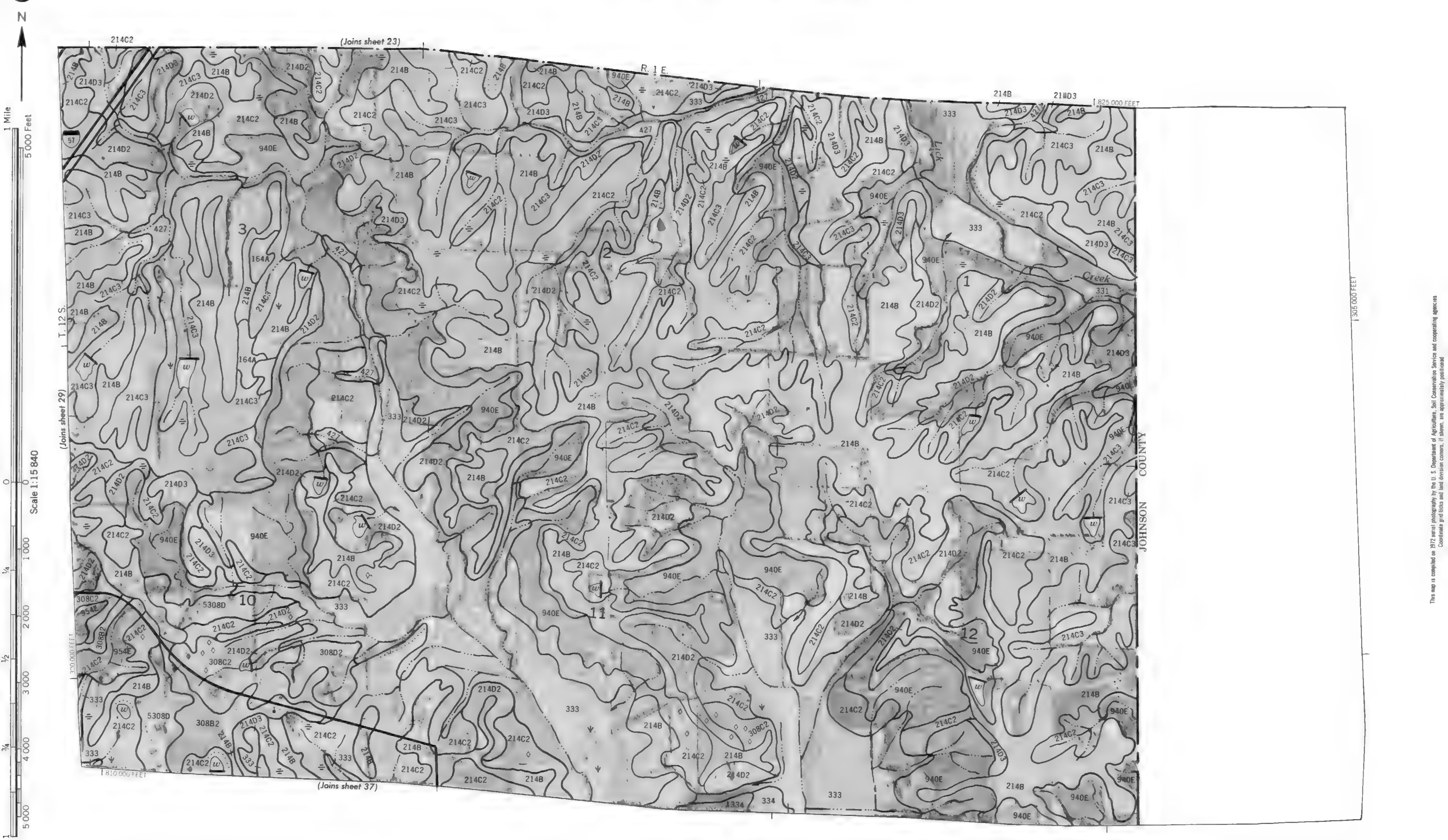
29

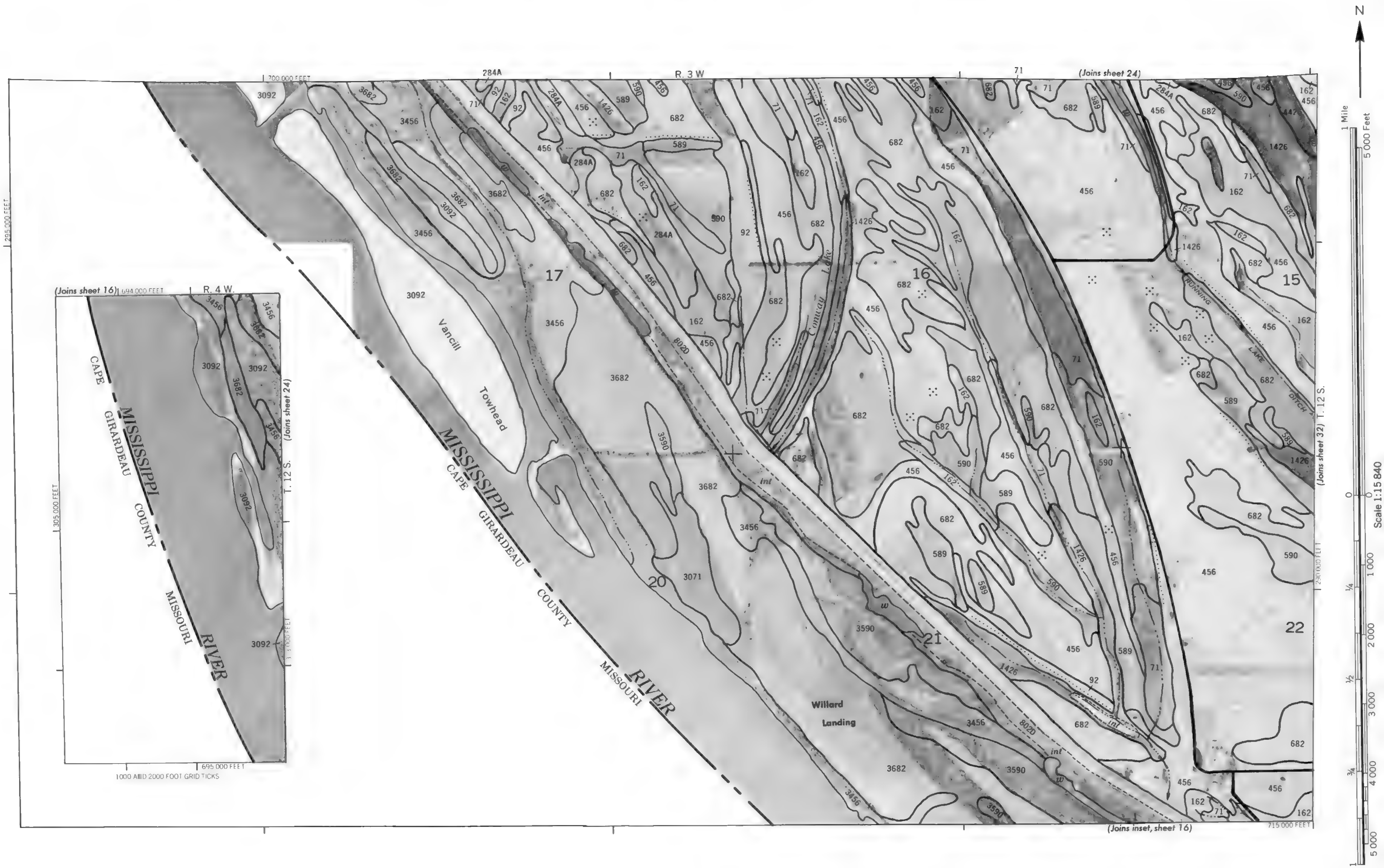
This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned

UNION COUNTY, ILLINOIS — SHEET NUMBER 3

This map is compiled on 1972 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned

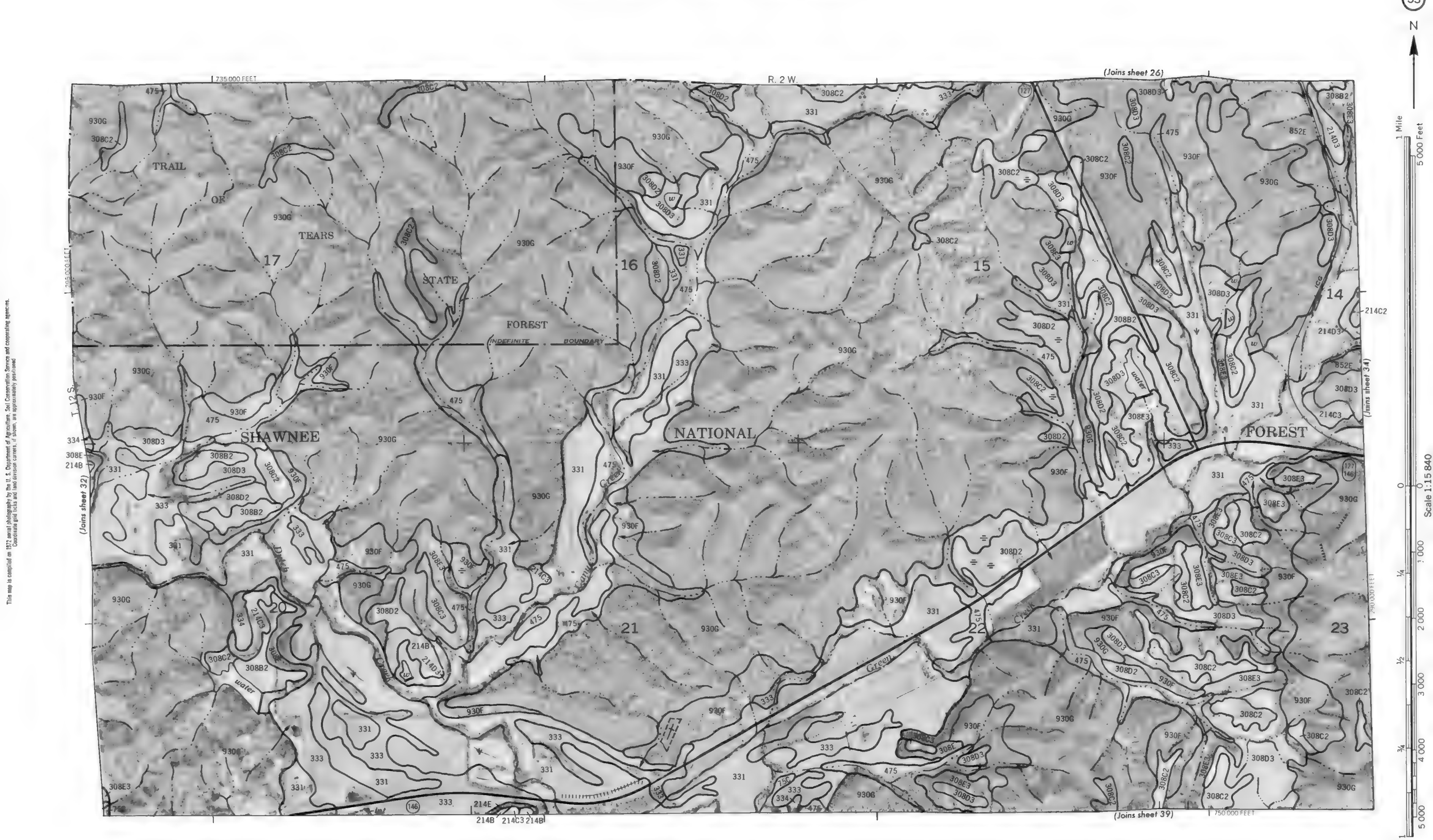
UNION COUNTY, ILLINOIS — SHEET NUMBER 30

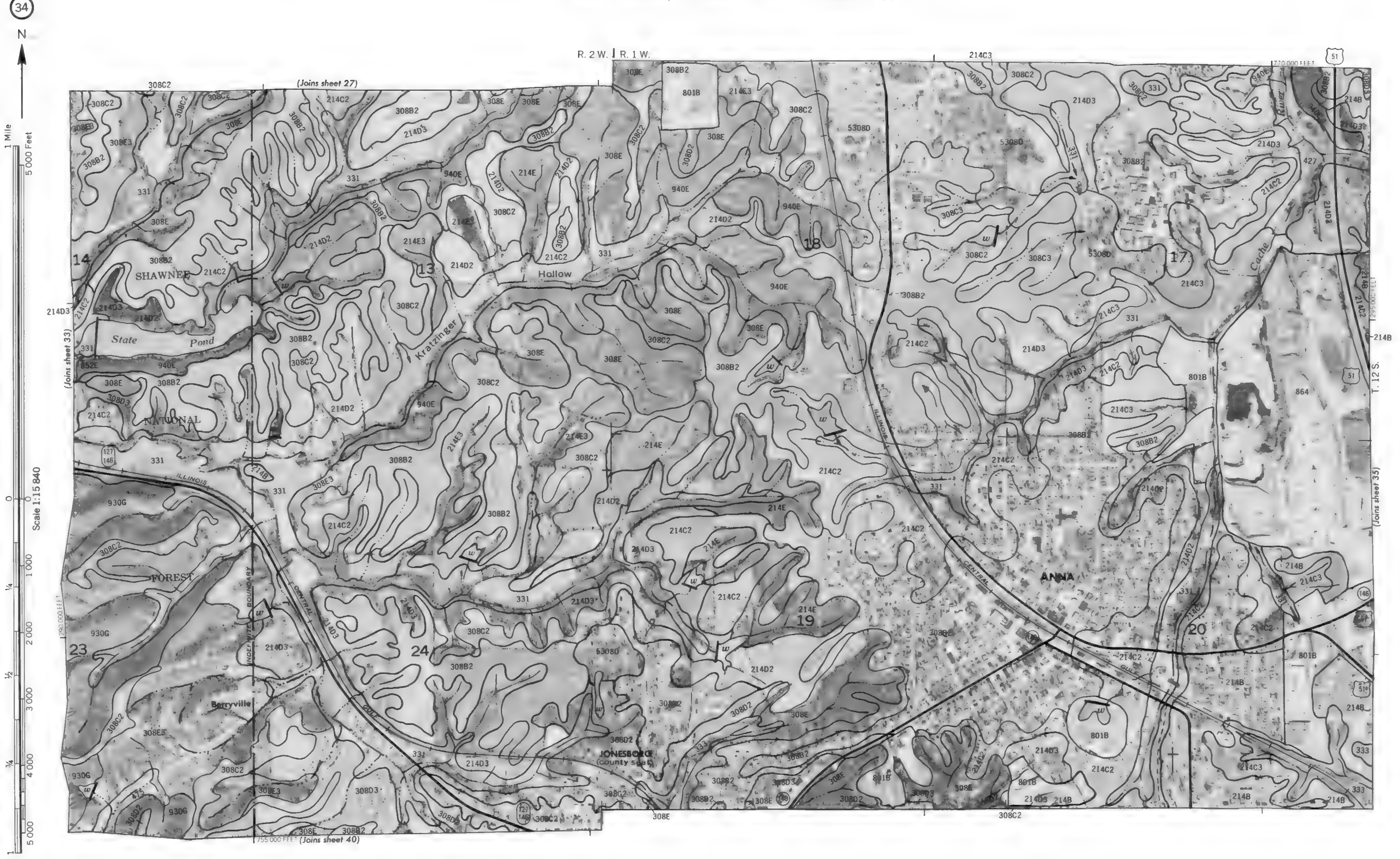




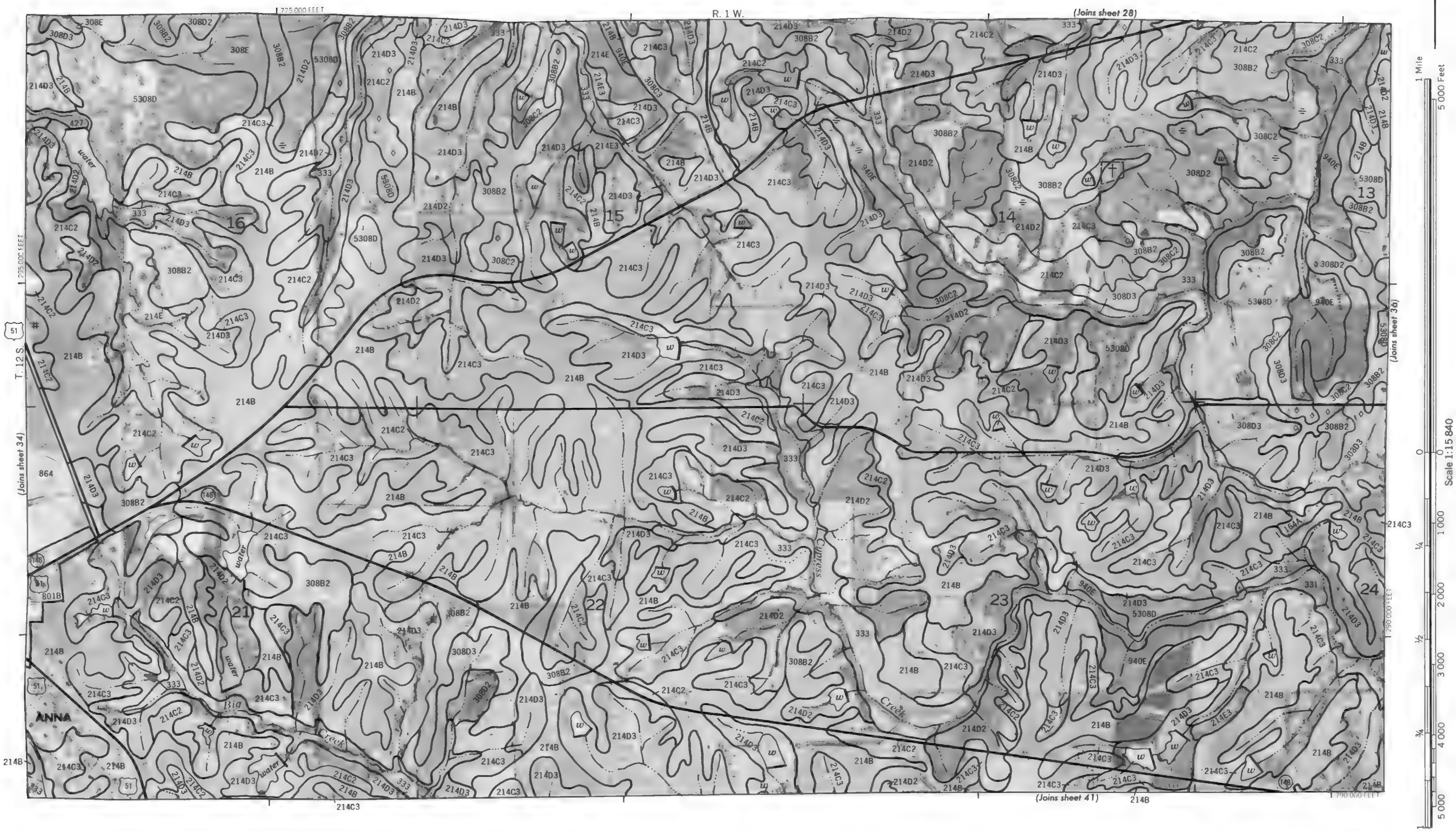
This map is compiled on 1972 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

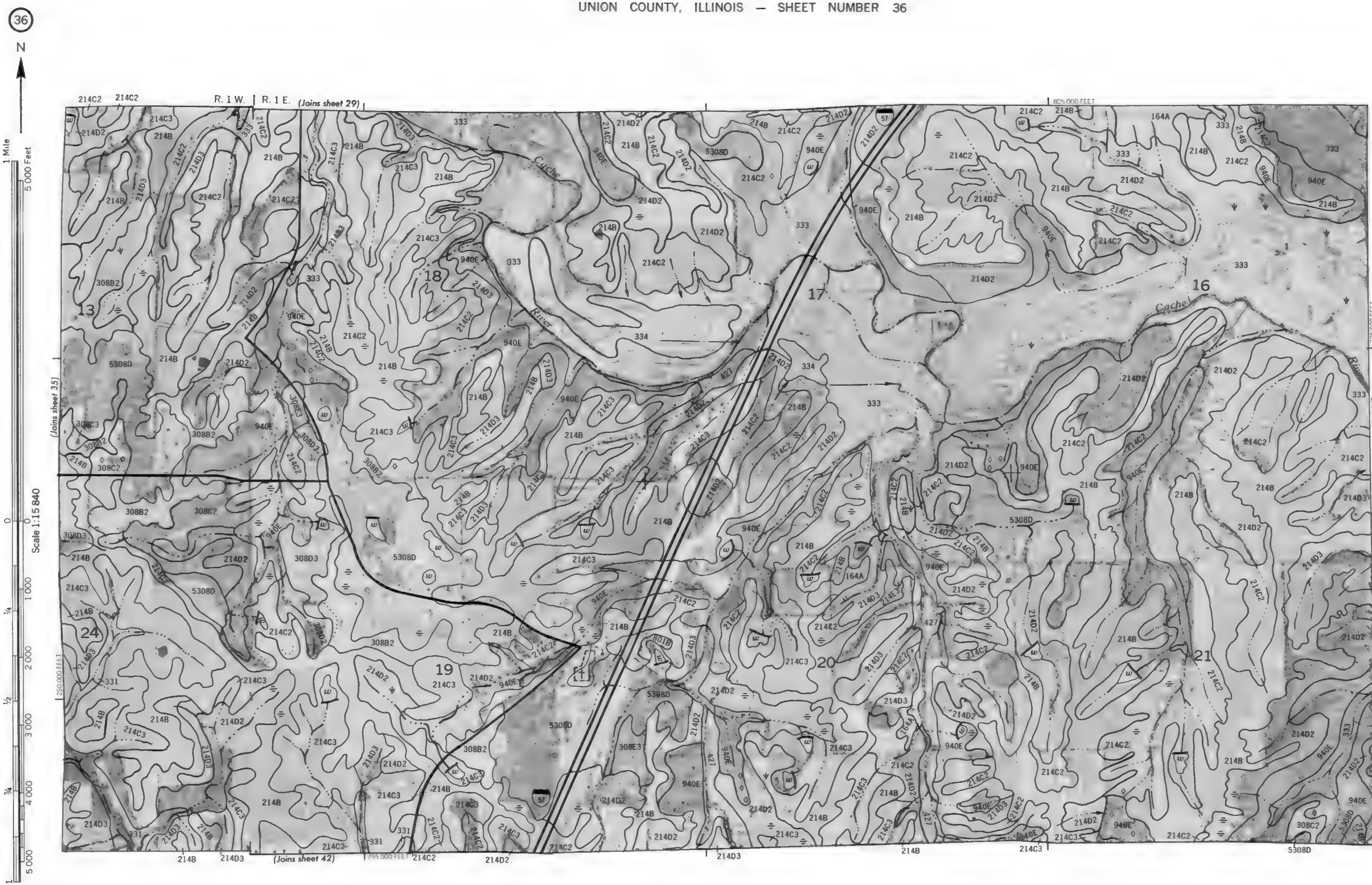

33
N
(Joins sheet 26)
R. 2 W.
735 000 FEET
TRAIL OF TEARS STATE FOREST
INDEFINITE BOUNDARY
SHAWNEE NATIONAL FOREST
T. 12 S.
(Joins sheet 32)
(Joins sheet 34)
(Joins sheet 39)
750 000 FEET
17
16
15
14
20
21
22
23
Green Creek
water
1 Mile
5 000 Feet
Scale 1:15 840
0
1/4
1/2
3/4
1 000
2 000
3 000
4 000
5 000
This map is compiled on 1977 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

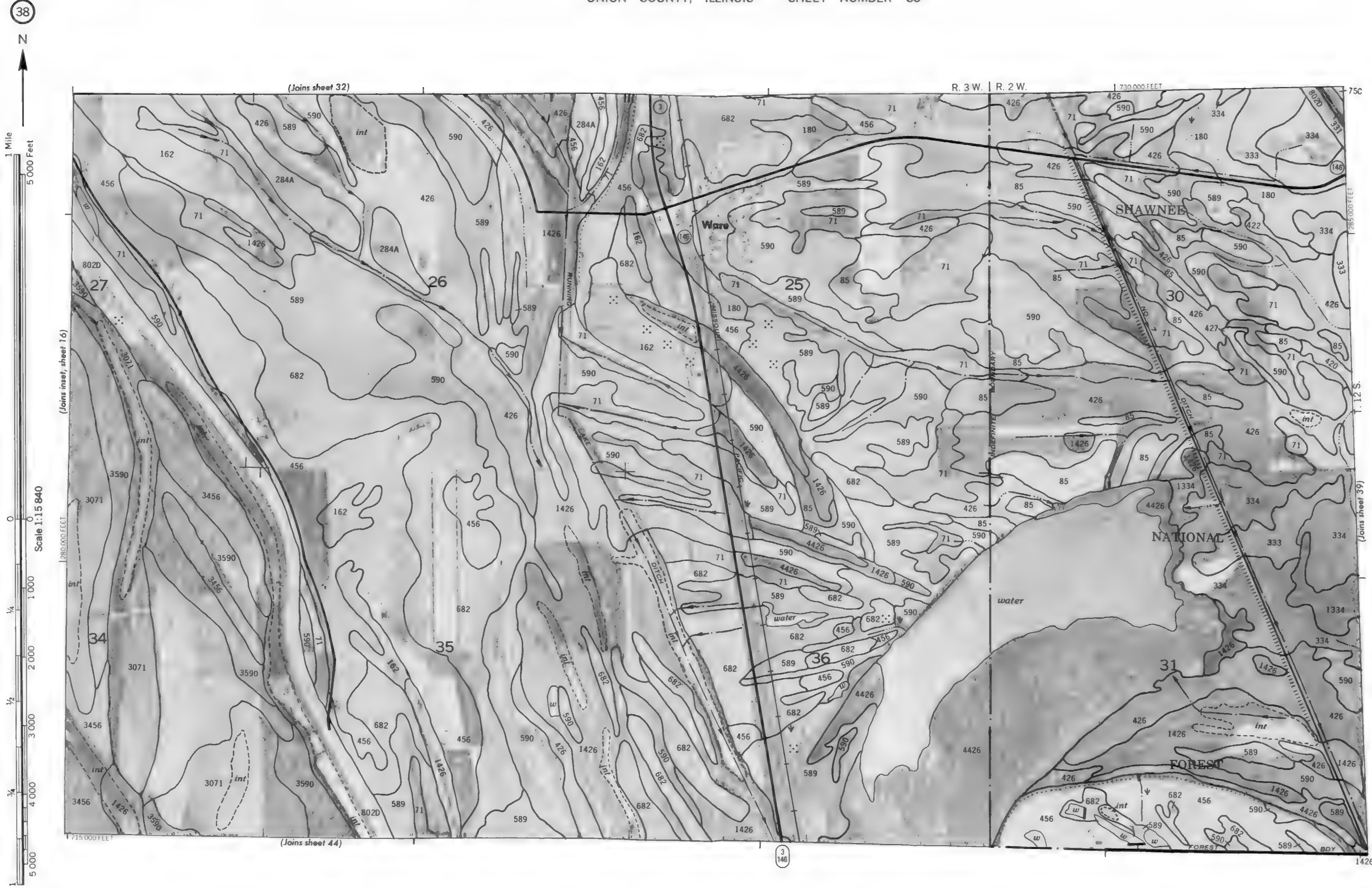


This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



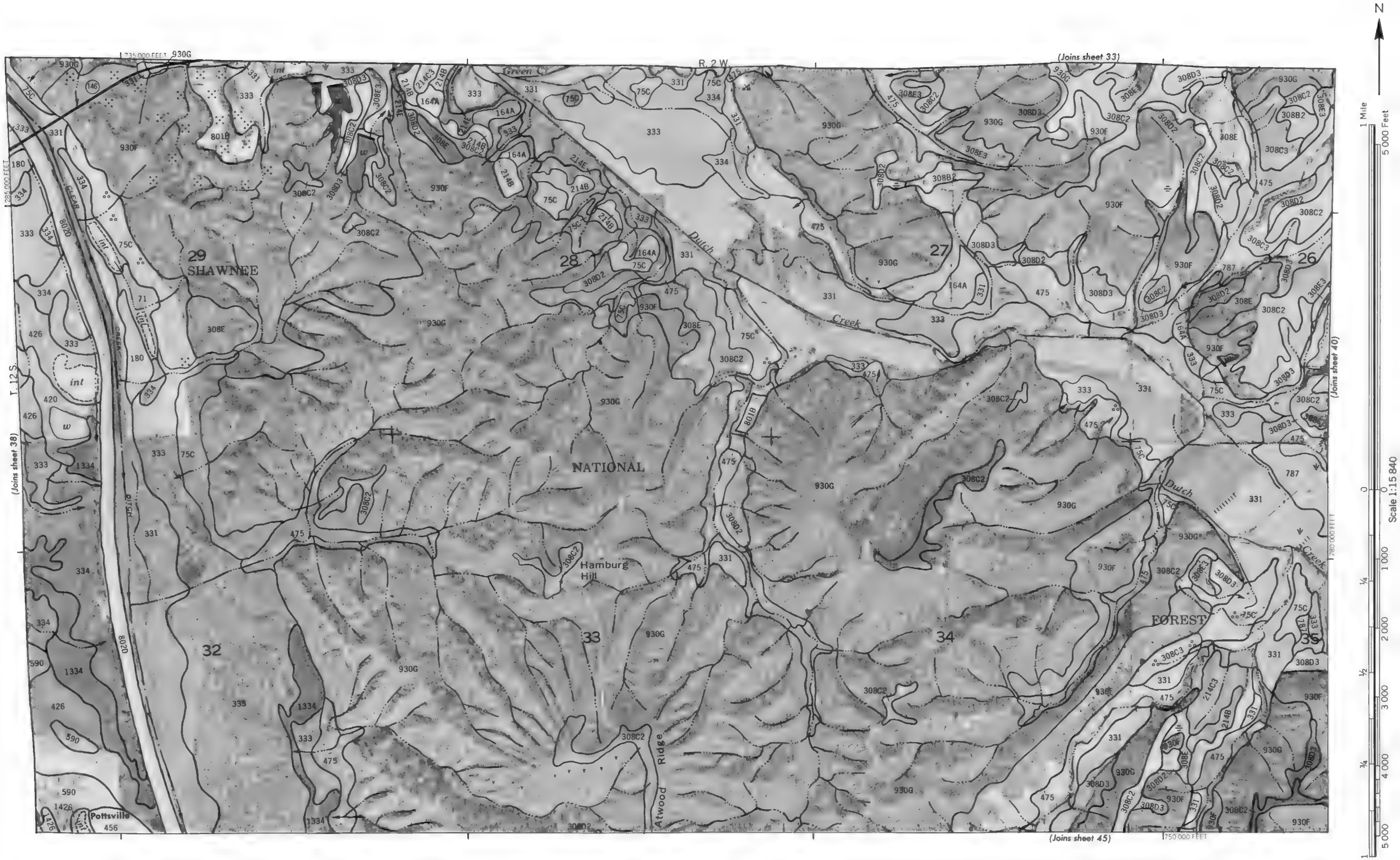
This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

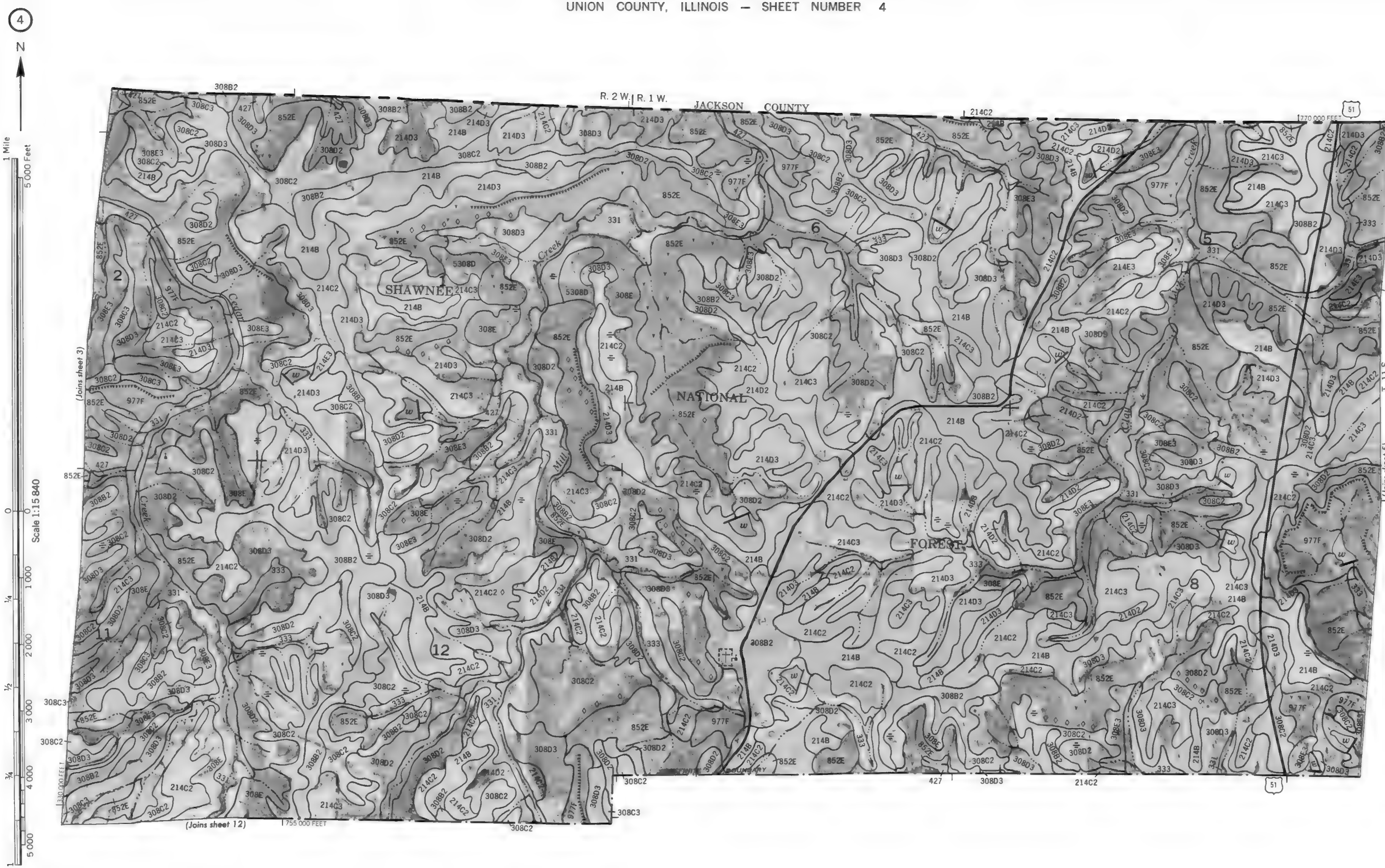


This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

39



This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



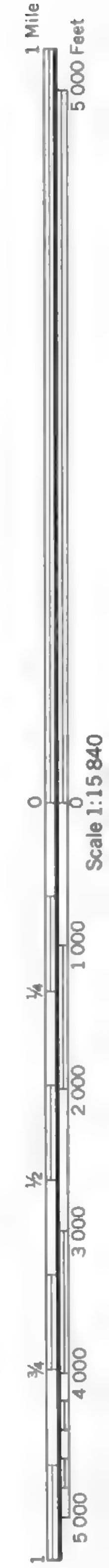
This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

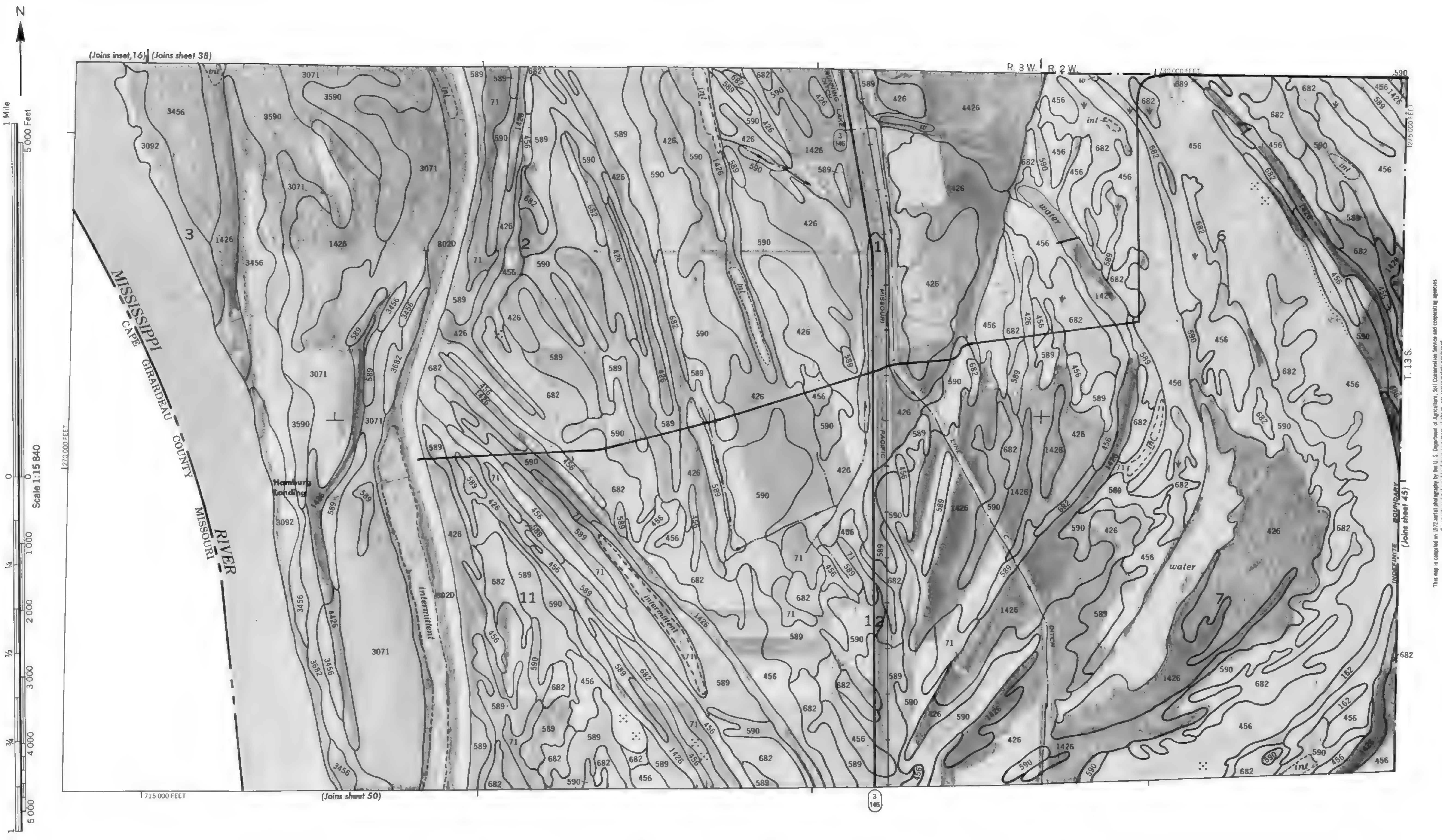
This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

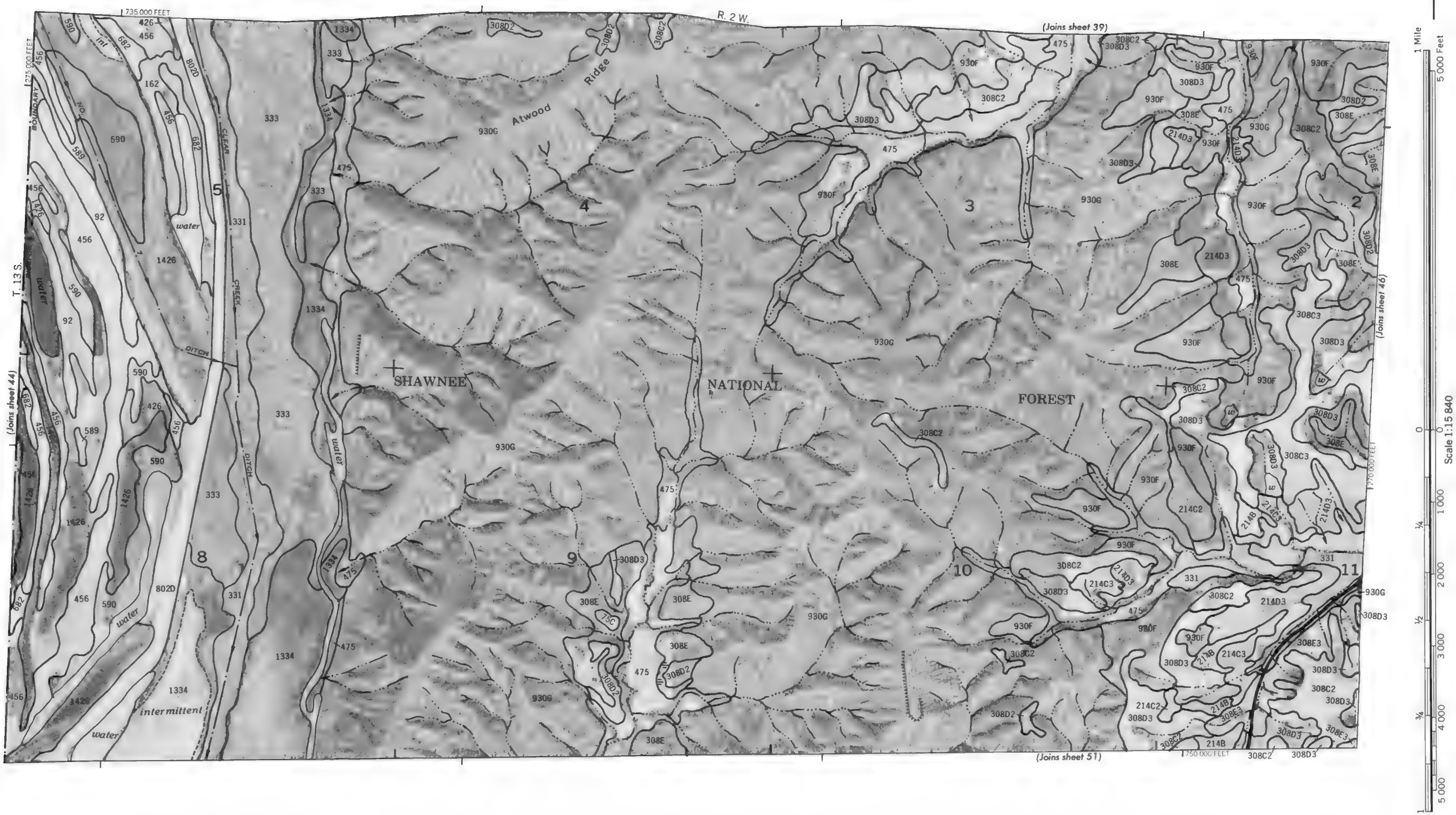
This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

43



This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.


N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins inset,16)
(Joins sheet 38)
(Joins sheet 50)
(Joins sheet 45)
R. 3 W.
R. 2 W.
T. 13 S.
730 000 FEET
275 000 FEET
270 000 FEET
715 000 FEET
MISSISSIPPI
RIVER
CAPE GIRARDEAU COUNTY
MISSOURI
Hamburg Landing
MISSOURI PACIFIC
intermittent
water
DITCH
INDEFINITE BOUNDARY
This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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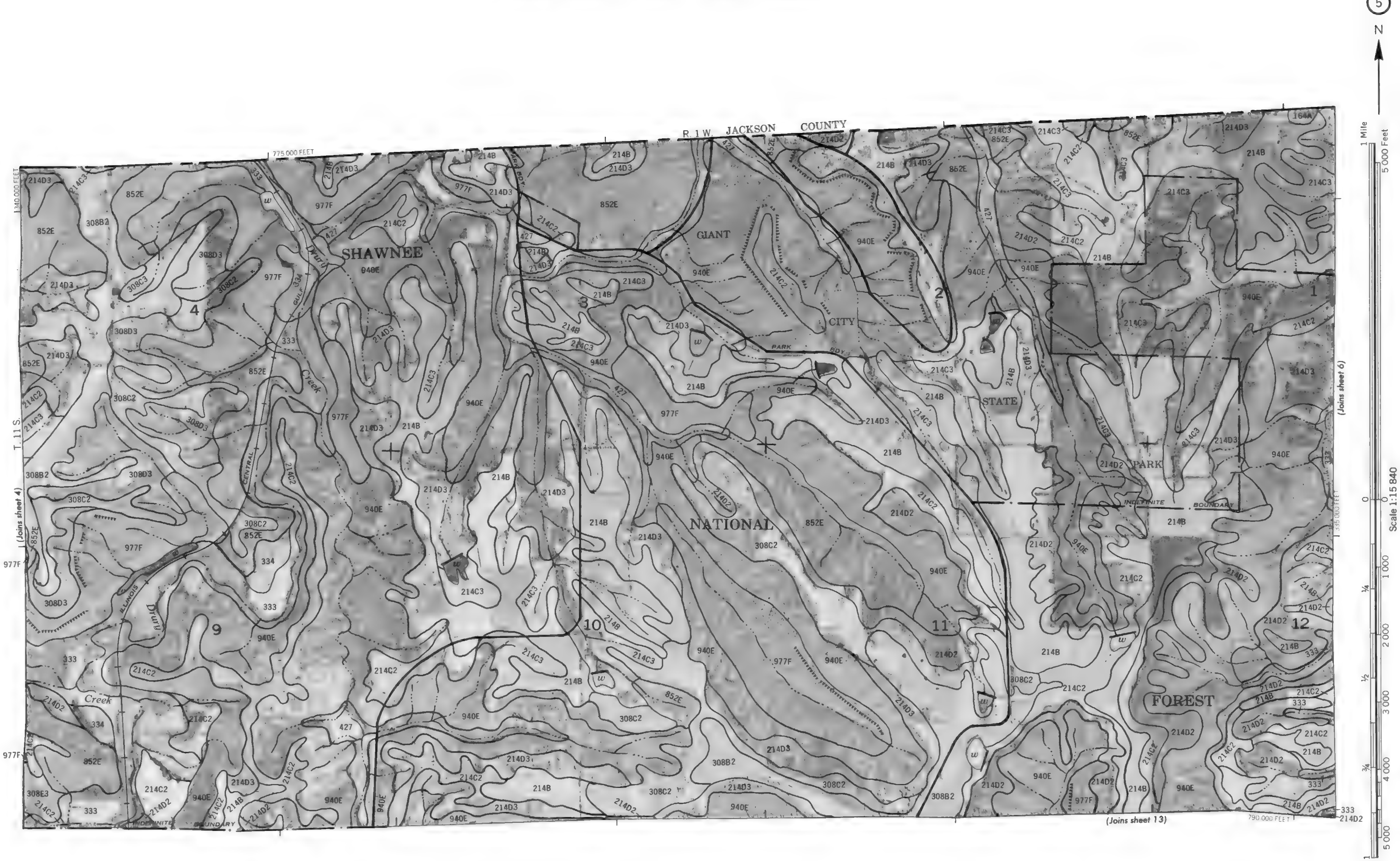
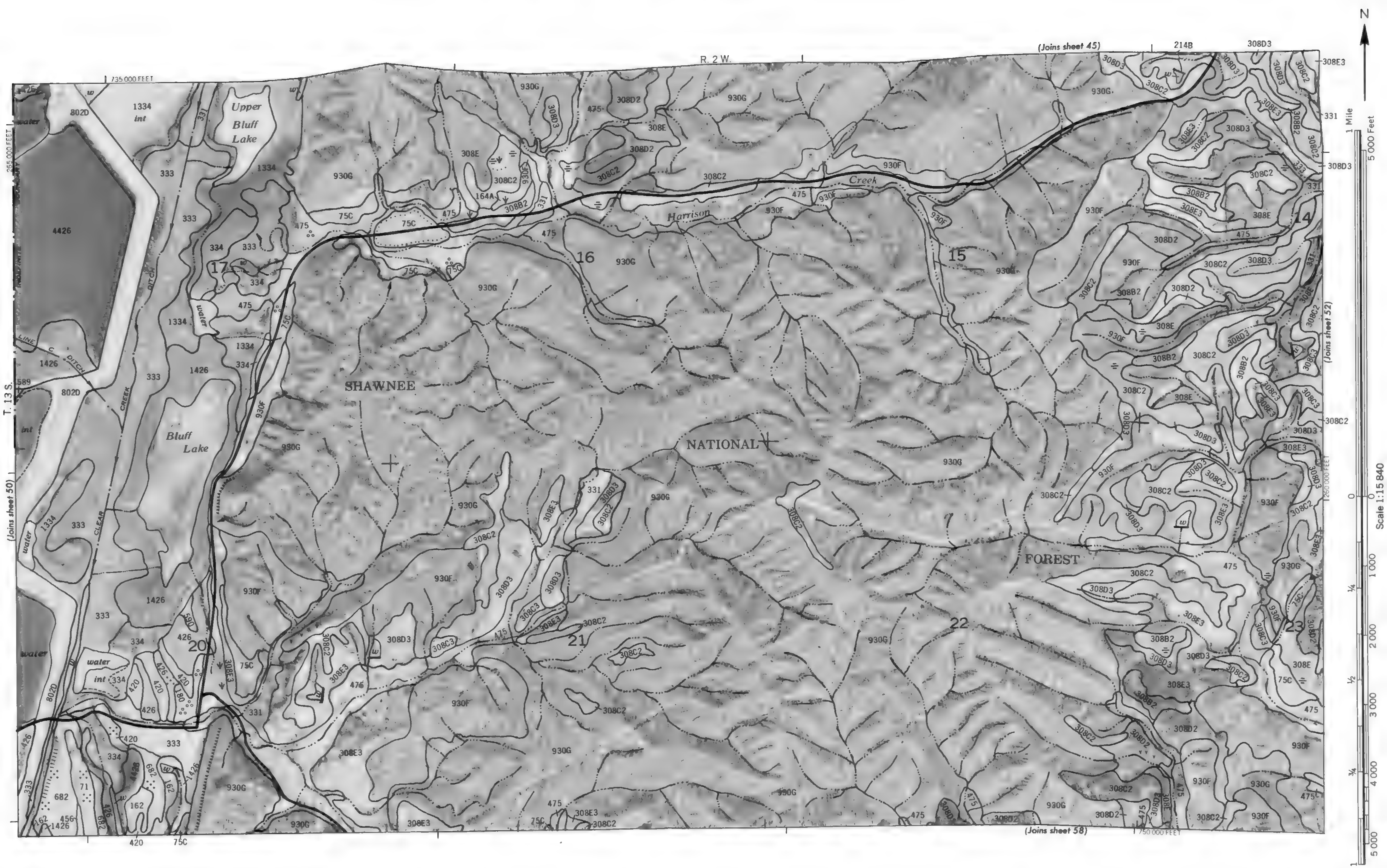
UNION COUNTY, ILLINOIS — SHEET NUMBER 48

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



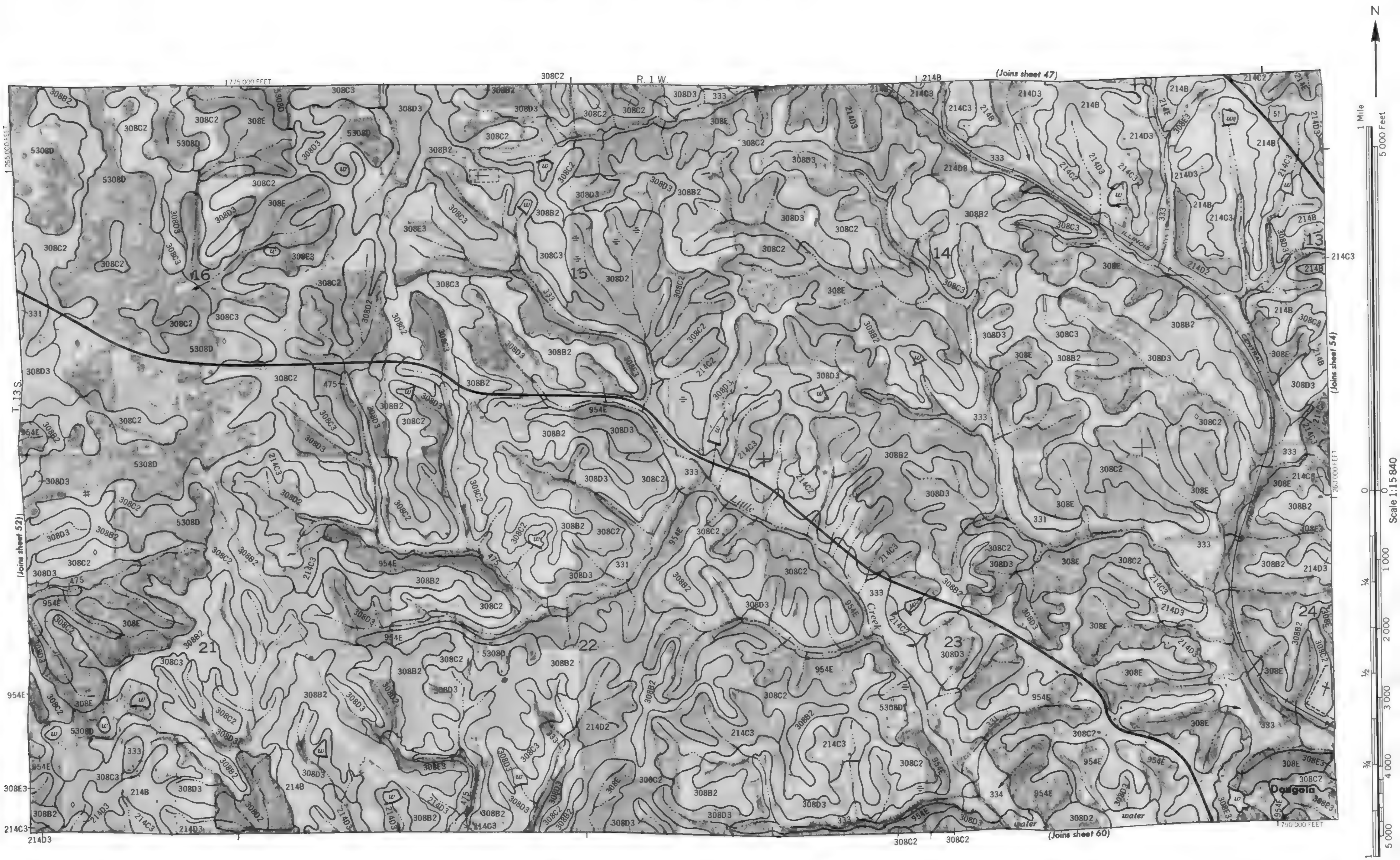
This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned



This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

N

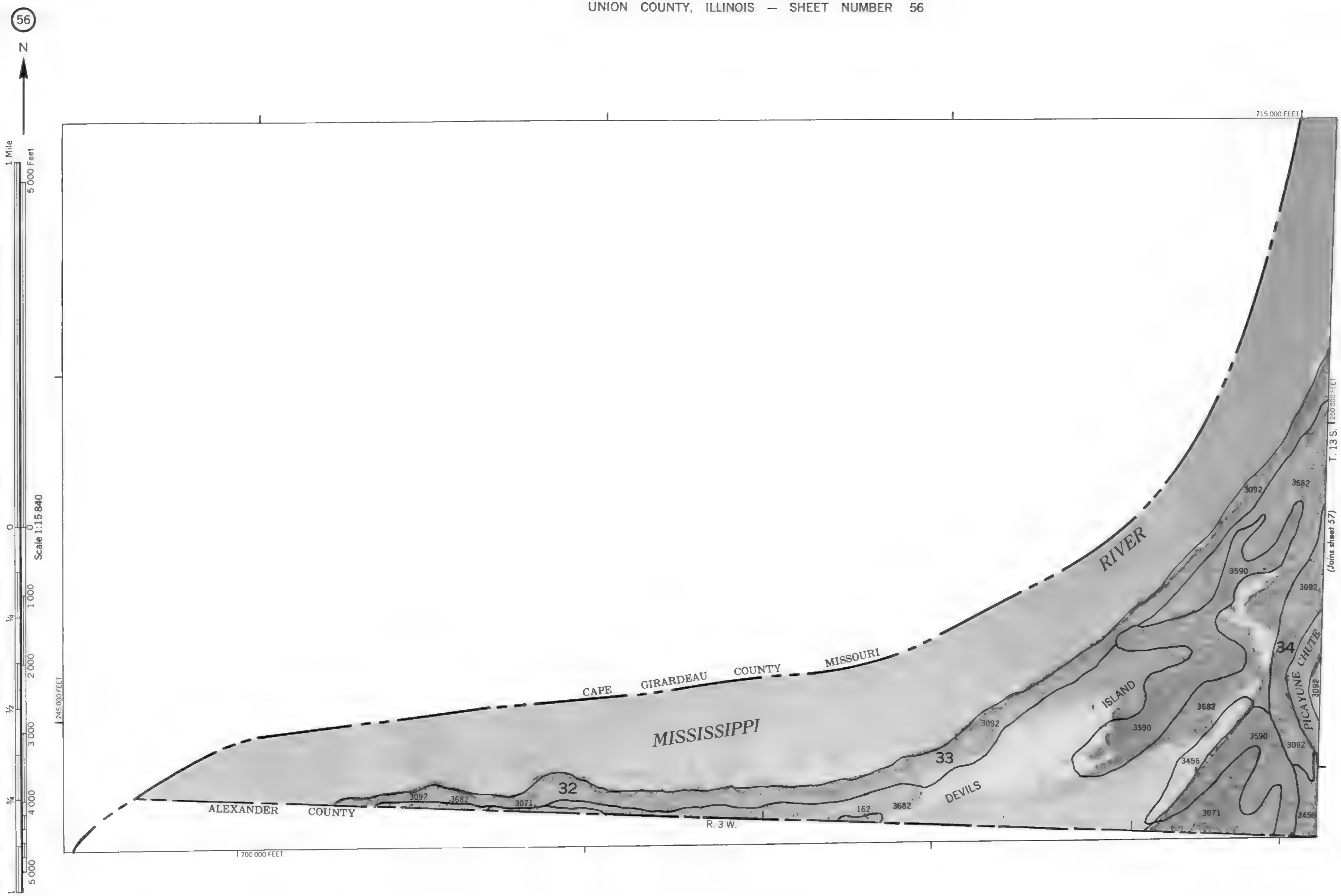
1 Mile

5 000 Feet

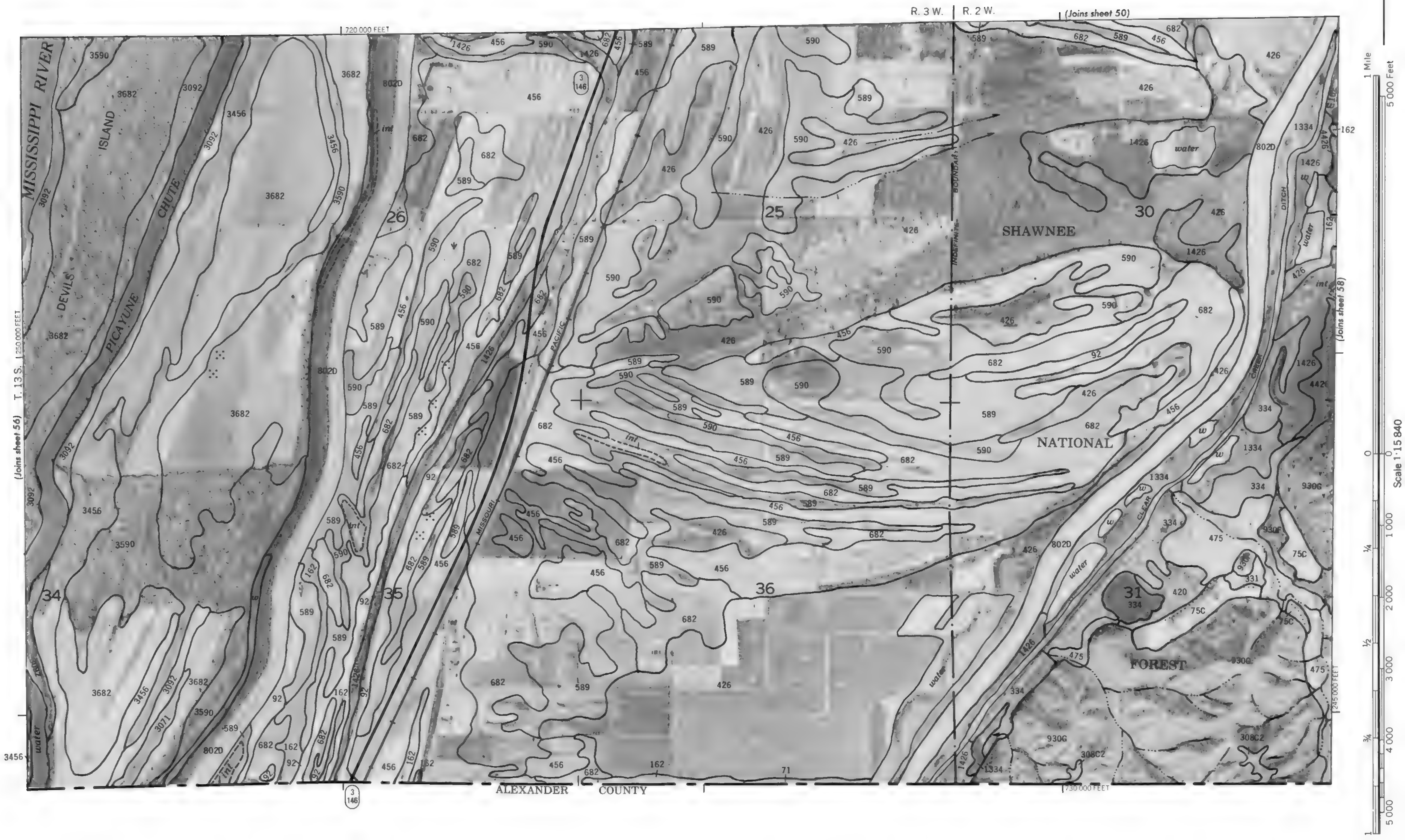
Scale 1:15 840

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

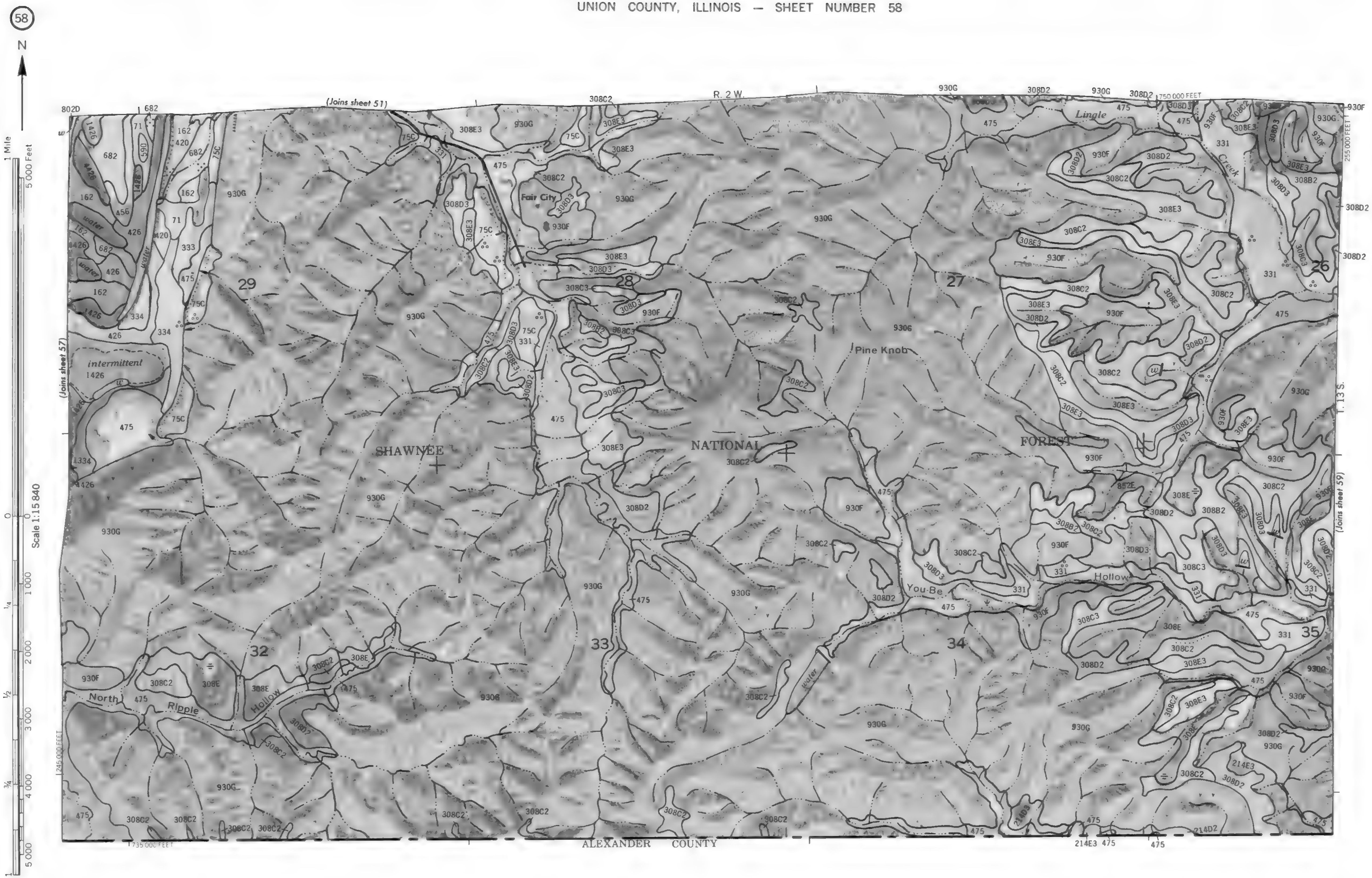
This map is compiled on 1977 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners, if shown, are approximately positioned

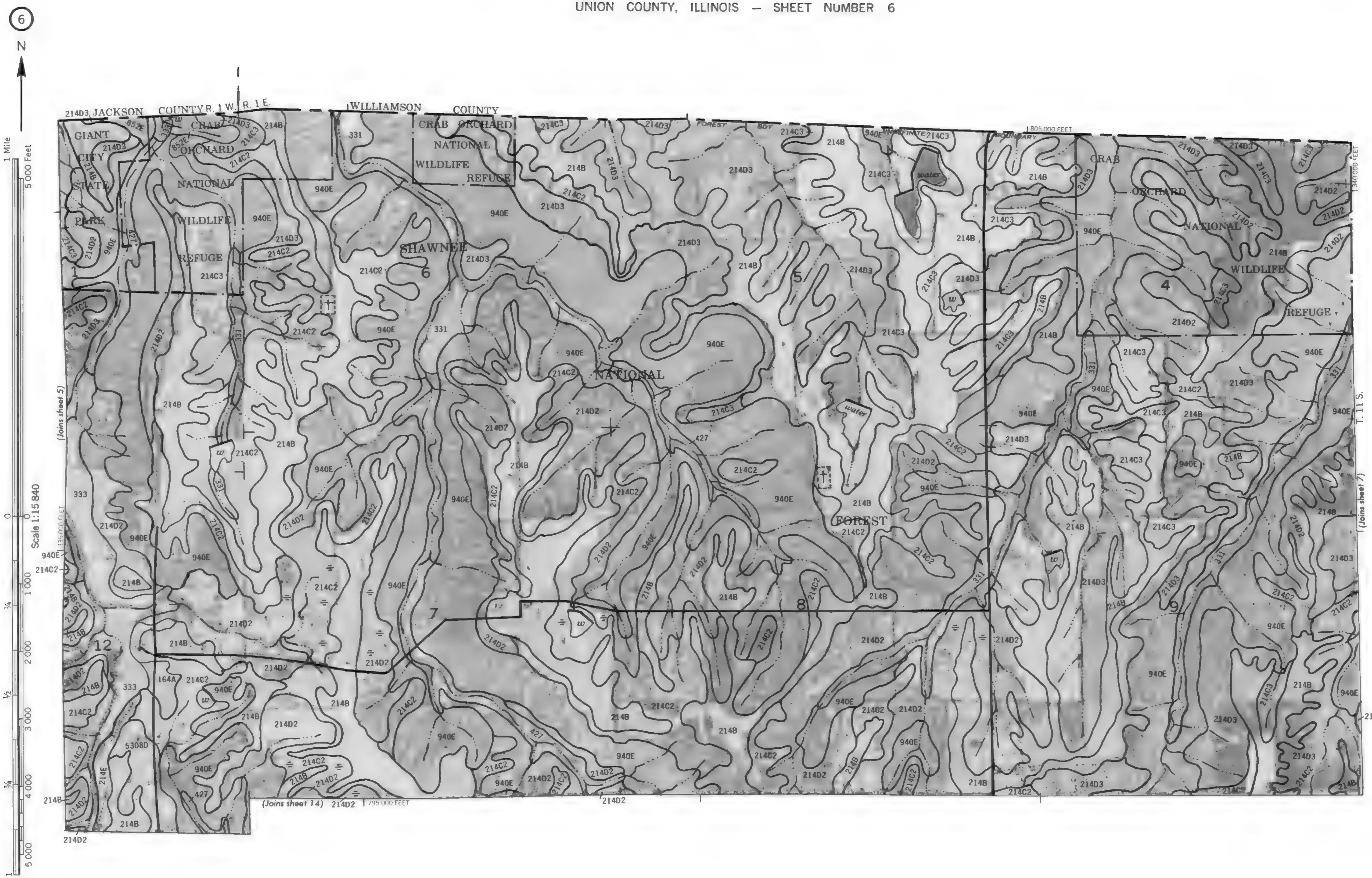


This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

60

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners, if shown, are approximately positioned

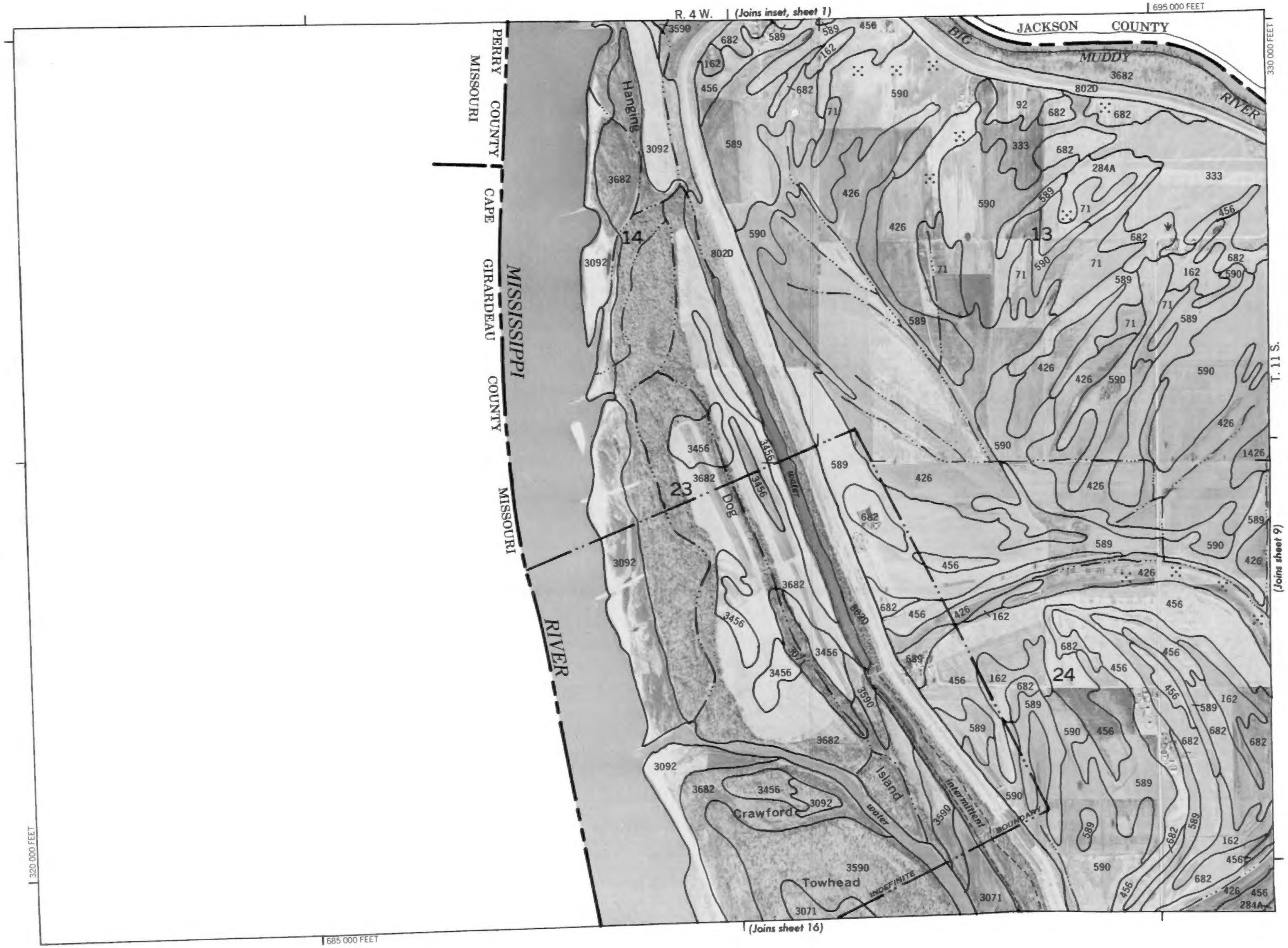
UNION COUNTY, ILLINOIS — SHEET NUMBER 62

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

8

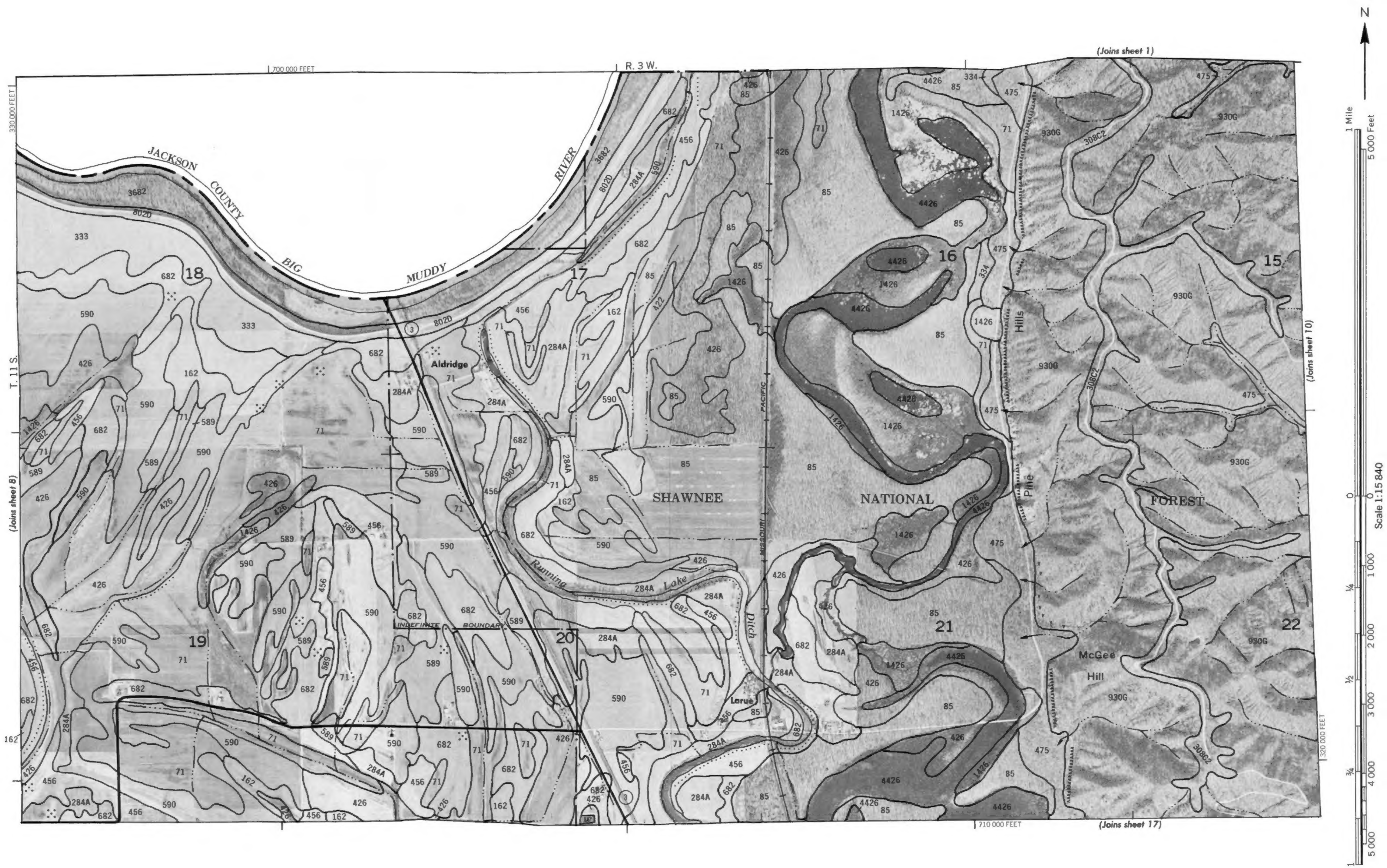
N



1 Mile
5 000 Feet
Scale 1:15 840
0 0
¼ 1 000
2 000
½ 3 000
¾ 4 000
1 5 000

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

9



This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.